TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS

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Dedicated

to

my family

&

Teachers

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Dr. Harleen Kaur

LIST OF ABBREVIATIONS

ATP	Adenosine triphosphate
ABCG	ATP-binding cassette subfamily G
AGEP	Acute generalized exanthematous pustulosis
BMI	Body mass index
BSA	Body surface area
CCL	Chemokine ligand
COPD	Chronic Obstructive Pulmonary Disease
CT	Computed tomography
CYP	Cytochrome
DLQI	Dermatology life quality index
FAE	Fumaric acid esters
GLUT	Glucose transporter
GPP	Generalized pustular psoriasis
HDL	High-density lipoprotein
HIV	Human immunodeficiency virus
HLA	Human leukocytes antigen
HPA	Hypothalamic-pituitary-adrenal axis
IBD	Inflammatory Bowel Disease
IgA	Immunoglobulin A
IL	Interleukin
iNOS	Inducible nitric oxide synthase
LDL	Low-density lipoprotein
MAPK	Mitogen activated protein kinase
MI	Myocardial infarction
MRP	Multidrug resistance protein
NAFLD	Non-alcoholic fatty liver disease
NB-UVB	Narrowband UVB
NF-κB	Nuclear factor kappa B
NPT	Sodium-dependent phosphate cotransporter
OAT	Organic anion transporter
OSAHS	Obstructive Sleep Apnea/Hypopnea syndrome

PASI	Psoriasis Area Severity Index
PsA	Psoriatic arthritis
PDE	Phosphodiesterase inhibitor
PSORS	Psoriasis susceptibility locus
PUVA	Psoralen plus UVA
RAR	Retinoic acid receptor
ROS	Reactive oxygen species
SCAT	Short-contact anthralin therapy
SJS	Stevens-Johnson syndrome
SUA	Serum uric acid
TEN	Toxic epidermal necrolysis
TGF-β	Transforming growth factor beta
Th cells	Helper T cells
TNF-α	Tumor necrosis factor alpha
UVA	Ultraviolet radiation A
UVB	Ultraviolet radiation B
VLDL	Very low-density lipoprotein
URAT	Urate transporter S
WHO	World Health Organization

ABSTRACT

Background: Psoriasis is a common, chronic, inflammatory skin condition influenced by genetic, environmental and immunological factors. Increased epidermal cell turnover can lead to raised levels of serum uric acid in psoriasis. Thus, monitoring of serum uric acid levels can facilitate early diagnosis, treatment and prevention of comorbidities leading to improved quality of life.

Objective: To study the serum uric acid levels in patients of psoriasis. To correlate the severity of disease with serum uric acid levels in patients of psoriasis.

Methods: This was a case-control study conducted at the Department of Dermatology, Dayanand Medical College and Hospital, Ludhiana. Clinically diagnosed cases of psoriasis and BMI matched controls equivalent to 1/4th of the total cases were taken during the study period of one year i.e. from 1 March,2021 to 28 February,2022. Patient's history was taken and thorough examination was done. Serum uric acid of the patients was correlated to PASI score, type of psoriasis and was compared with serum uric acid levels of BMI matched controls.

Results: Mean SUA of cases was 5.88±1.67 mg/dl whereas the mean SUA of controls was 5.27±1.19 mg/dl. Serum uric acid was raised in fifteen cases (25%) compared to two (13.3%) controls (p=0.334). Hyperuricemia was seen in 60.0% of cases with PASI> 20 compared to 33.3% of cases with PASI 10-20 & 6.7% of the cases with PASI<10. SUA levels showed a statistically significant association with PASI score (p=0.019).

Conclusions: Our study concludes that SUA levels increase with the increase in the severity of psoriasis. Monitoring of SUA levels during treatment and follow up of psoriasis patients can prevent its deleterious effects on psoriasis.

Key words: Psoriasis, Psoriasis area severity index (PASI) score, Serum uric acid.

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INTRODUCTION

Psoriasis is a common, chronic, inflammatory and proliferative condition of the skin, associated with systemic manifestations in many organ systems. Genetic, immunological and environmental influences have a critical role in the etiology and pathogenesis. Environmental risk factors include streptococcal pharyngitis, obesity, trauma, low humidity, etc.[1]

According to various epidemiological studies estimated worldwide prevalence of psoriasis is found to be 0.6% to 4.8% with higher prevalence in developed countries.[2]

Psoriasis can occur at any age though the mean age of onset for the first occurrence is between 15-20 years, with a second peak at 55-60 years with males being more commonly affected.[3]

Amongst the various ethnic groups, psoriasis is more commonly seen in whites. High prevalence is also found in those living at higher latitudes.[4] Psoriasis is aggravated during winters and stress and improves during summers. Acute episodes of guttate psoriasis can occur following a respiratory tract infection.[5]

Th17 cells play a key role in the pathogenesis of psoriasis by increasing various cytokines such as IL-17A, IL-17F & IL-22 and chemokines which increase keratinocyte proliferation and lead to infiltration of inflammatory cells into the skin including lymphocytes, neutrophils and monocytes. Inflammation seen in psoriatic skin lesions is also induced by increased expression of antimicrobial peptides LL-37 which causes activation of dendritic cells.[6]

HLA typing studies on the Indian population have shown a significant association between psoriasis and HLA A1, B17 and Cw6.[7]

Pathophysiology of psoriasis is characterized by decreased cell turnover time from normal 311 hours to 36 hours with increased cell growth fraction from normal being 60% to almost 100% seen in psoriatic skin lesions. This forms the basis of hyperproliferation of epidermis evident in psoriasis.[8]

Psoriasis is a papulosquamous disorder with classical skin lesions consisting of well-circumscribed, circular, reddish papules or plaques covered with silvery white, grey or dry scales. Lesions are symmetrical in distribution and most commonly involve the scalp, elbows, knees and lumbosacral region. It may also involve body folds. Koebner's phenomenon can be demonstrated in psoriasis i.e. development of isomorphic skin lesions along the line of trauma or injury.[9]

The most common symptoms associated with the disease include intense itching, irritation, pain, burning sensation and bleeding. Oral mucosa or the tongue may be occasionally involved. The severity of symptoms correlates with the severity of the disease.[10]

According to the different clinical features, psoriasis is divided into five types:

- Plaque psoriasis
- Guttate psoriasis or eruptive psoriasis
- Inverse psoriasis
- Pustular psoriasis
- Erythrodermic psoriasis

Chronic plaque psoriasis is the most common type seen accounting for nearly 90% of all cases.[3,9]

Plaque psoriasis presents with a variable clinical course and the possibility of spontaneous resolution. Flexural psoriasis involves the body folds. Guttate psoriasis develops abruptly following an episode of viral or bacterial infections. Pustular and erythrodermic are forms of psoriasis with severe clinical manifestations.[11]

Generalized pustular psoriasis is a life-threatening form of disease requiring hospitalization. Patients usually present with multiple flares associated with systemic manifestations and complications like renal failure, sepsis, etc. Mortality rates vary from 2% to 16%.[12]

Nail changes are reported in up to 50% of psoriasis patients and up to 90% of patients with associated psoriatic arthritis. These changes include subungual hyperkeratosis, nail pitting, splinter hemorrhages, onycholysis, etc. The most common clinical sign is nail pitting. Nail

psoriasis can be severe and lead to significant loss of function if not treated.[13]

Psoriatic arthritis (PsA) is another entity found to be present in 7% to 42% of the cases. It consists of seronegative inflammatory arthritis involving small joints in an asymmetrical pattern. This commonly leads to pain and disability which compromises the life of patients.[14]

PsA can either precede or succeed the development of skin lesions and can even begin simultaneously. While this equally affects both males and females who are genetically predisposed, trauma acts as a triggering factor initiating the disease. There is more chance of nail psoriasis in patients with associated psoriatic arthritis.[15]

Psoriasis is not exclusively a dermatological disease. It can affect various organ systems as well. Studies have shown a high prevalence of metabolic syndrome in psoriasis patients. Adipocytokines such as TNF-α and adiponectin play a key role in both metabolic syndrome as well as psoriasis. There is an increased incidence of comorbidities like diabetes, hypertension, obesity, etc. Psoriasis is also considered an independent risk factor for cardiovascular disease.[16]

Like other chronic skin conditions such as acne and vitiligo, psoriasis can also lead to significant psychosocial and physical impairment. There is an increased incidence of depression and anxiety among these patients. The involvement of palms and soles leads to decreased productivity at work. Psoriasis also leads to decreased reproductivity among women of childbearing age. High visibility of lesions, as well as associated pain adversely affects the social life of patients and results in risk aggravating behavior such as smoking and alcoholism.[17]

The total cost of treatment, decreased productivity at work with increased work loss days and psychosocial impact of disease attribute significantly to the economic burden. This increases with the duration of the disease and increased comorbidities.[18]

The characteristic pathological process in psoriasis involves increased mitotic activity of the basal cell layer resulting in rapid epidermal cell turnover with the 28-day normal epidermal cell cycle reduced to 5 days. The mitotic activity of cells involves purine (adenine and guanine)

metabolism, the end product of which is uric acid. Therefore, it is likely that increased serum uric acid levels in psoriasis are due to increased mitotic activity of the cell resulting in an increased nucleic acid turnover. This is similar to hyperuricemia seen in myeloproliferative disorders.[19] Serum uric acid levels are expected to vary with the duration and severity of the disease.

Uric acid is the end product of purine metabolism both from an endogenous or dietary source. When in excess it forms monosodium urate crystals which deposit in skin, joints and renal tubules. SUA contributes to the antioxidant properties of human plasma.[20]

Normal serum uric acid levels in males are 3.4-7mg/dl whereas in females it is 2.4-5.7mg/dl.[21] Hyperuricemia is defined as serum uric acid levels greater than 6mg/dl in females and greater than 7mg/dl in males.[22]

Since SUA levels may vary with the extent of skin involvement in psoriasis so Psoriasis Area Severity Index (PASI) score is used to calculate the severity of the disease. PASI score varies from 0-72 and is calculated for different anatomical sites (head, upper limbs, trunk, lower limbs) on the basis of the extent of involvement and severity of signs –

- Erythema
- Induration
- Scaling

PASI correlated directly with the severity of psoriasis and shows an inverse correlation with DLQI. A 75% reduction in PASI score significantly improves the quality of life of the patient.[9,23]

Hyperuricemia due to various factors such as excessive alcohol intake, meat consumption and drugs such as diuretics, etc. can lead to an imbalance between production and excretion of SUA, as a consequence levels of SUA in body fluids exceed physiological limits which then accumulates as monosodium urate monohydrate crystals around joints leading to an attack of acute gout. This manifests as an

acute attack of severe pain and inflammation frequently affecting the first metatarsophalangeal joint. This is more commonly seen in men.[24]

Hyperuricemia is not only directly related to gout, but also to cardiovascular disease (especially sudden cardiac death), hypertension, diabetes, metabolic diseases, etc.

SUA contributes to the antioxidant properties of plasma in the early stages of atherosclerosis but when present in excess it exerts pro-oxidant properties in the late stages of atherosclerosis. Thereby leading to an increased risk of coronary artery disease. Thus, SUA levels correlate with the development of cardiovascular disease and act as an independent risk factor.[25]

Hyperuricemia is considered a true risk factor for renal disease because elevated SUA levels cause cortical vasoconstriction and glomerular hypertension thus inducing tubular ischemia and glomerular damage. In the case of preexisting renal disease, hyperuricemia worsens the disease. Therefore, lowering SUA levels can slow the progression of kidney disease.[26]

Drug-induced hyperuricemia accounts for nearly 20% of all the cases with elevated SUA. Drugs causing increased SUA levels include antitubercular drugs, cytotoxic drugs, diuretics, immunosuppressant agents, fructose, lactose infusion, etc. Even long term use of drugs used for the treatment of psoriasis such as acitretin, cyclosporine and methotrexate can lead to hyperuricemia.[27,28]

SUA levels show a positive correlation with PASI score, and BMI. Apart from SUA, the inflammatory process in psoriasis is also associated with elevated levels of C- reactive protein which increases arterial stiffness and predisposes to the development of premature cardiovascular disease.[29]

Metabolic syndrome comprises central obesity, insulin resistance, dyslipidemia, and elevated blood pressure.[30] Studies have shown that hyperuricemia is a risk factor for metabolic syndrome. Elevated SUA act as a predictor for components of metabolic syndrome such as hypertension and hyperglycemia.[31]

Psoriasis makes a person both physically and psychologically disabled. Often people with severe psoriasis are obese. Obesity itself is a strong predictor of SUA levels. Thus both obesity and hyperuricemia manifold the risk of cardiovascular disease in these patients.[32]

Since psoriasis extends beyond skin and joints, diagnosis and appropriate management of this chronic inflammatory disorder becomes essential. Diagnosis of psoriasis is mainly clinical. Occasionally skin biopsy may be required in case of atypical presentation. Management of psoriasis depends on the disease severity. It varies from topical therapy including topical corticosteroids and vitamin D3 analogues etc. for mild to moderate disease to systemic therapy including phototherapy, methotrexate, acitretin, cyclosporine and biological agents in cases with severe disease.[33]

Elevated SUA increases the comorbidities associated with psoriasis so appropriate management includes lifestyle modifications such as dietary advice, limited alcohol intake, exercise, etc.[34]

Drug therapy for hyperuricemia includes xanthine oxidase inhibitors and uricosuric agents which decrease uric acid production and increase the excretion of uric acid respectively.[35]

Psoriasis is a chronic, multisystem disease with great physical, psychological, emotional and social impact on the life of the patient. It affects interpersonal relationships. It is associated with further deterioration of the quality of life of these patients. Elevated SUA levels themselves act as a risk factor for a large number of life-threatening diseases such as premature cardiovascular diseases, chronic kidney disease and metabolic syndrome which increase the morbidity and mortality associated with psoriasis.[33] Being aware of the above comorbidities and complications associated with psoriasis and hyperuricemia, early diagnosis of psoriasis, and estimation of serum uric acid levels may facilitate early and appropriate treatment initiation and prevention of comorbid conditions. Monitoring the levels of serum uric acid levels is necessary for physicians as well as dermatologists, as many of these conditions are treatable leading to improved quality of life and reduction in physical and psychological burden.

AIMS AND OBJECTIVES

1. To study the serum uric acid levels in patients of psoriasis.
2. To correlate the severity of disease with serum uric acid levels in patients of psoriasis.

REVIEW OF LITERATURE

Psoriasis is a chronic inflammatory skin disease influenced by genetic, environmental and immunological factors. It is characterized by episodes of exacerbations and remission during the course of the disease.[3] It affects approximately 2-4% of the population in western countries.[36]

The prevalence of psoriasis varies geographically as well as amongst various ethnic groups with higher prevalence rates in locations far away from the equator.[37] Some ethnic groups such as the Japanese report a low prevalence of the disease.[38] Psoriasis can affect people of any age group and presents with a bimodal distribution of disease onset.[39]

Clinically, it is characterized by sharply demarcated, red, indurated plaques covered with silvery white scales. These plaques may be associated with severe pruritus or pain.[40] Psoriasis is a multisystem disease with skin and joint involvement and associated comorbidities including metabolic syndrome, cardiovascular diseases, psychiatric disorders, etc. As per studies, at least one comorbidity is present in 73% of psoriatic patients.[41]

Psoriasis can adversely affect the quality of life with a significant impact on physical, social and emotional well-being.[42,43] Psoriasis can lead to great functional disability even more than serious diseases like heart disease, cancer, etc.[44]

Pathogenesis of psoriasis

Various genetic, environmental and immunological factors play a key role in the pathogenesis of psoriasis.

Genetic factors

Genetic factors play an important role in psoriasis. This is evidenced by a study conducted in North India where positive family history was seen in 9.8% of children.[45] Nearly 30% of the patients have a history of

psoriasis in first-degree relatives and more the number of relatives affected, higher the risk of acquiring the disease.[46] As per twin pair analysis, the concordance rate among monozygotic and dizygotic twins is 72% and 22% respectively.[47]

In a series of patients examined by Henseler and Christophers, they reported two types of psoriasis - type I and type II psoriasis. Type I presents as early onset, severe disease which begins at ≤ 40 years and has a strong association with HLA-Cw6. Whereas type II or late-onset disease begins at ≥ 40 years of age and has fewer numbers of relatives affected as compared to type I disease.[39]

Out of multiple genes which are involved in the pathogenesis of psoriasis, the major locus is PSORS1 on chromosome 6p21 with HLA-Cw*0602 being its susceptibility allele.[48] GWA studies and linkage analysis have shown variable association with other loci which include 6p (PSORS1), 17q25 (PSORS2), 4q34 (PSORS3), 1q21 (PSORS4), 3q21 (PSORS5), 19p13 (PSORS6), 1p32 (PSORS7), 16q (PSORS8) and 4q31 (PSORS9).[49]

IL-36 receptor antagonist is encoded by the IL36RN gene located on chromosome 2q13. In a study conducted by Marrakchi et al., it was reported that missense mutation in the IL36RN gene resulted in upregulation of inflammatory cytokine production and increased risk of development of generalized pustular psoriasis.[50]

Environmental factors

Several environmental factors known to trigger disease in genetically predisposed individuals include drugs, trauma, infections, stress, and diet.

Drugs – Certain drugs can induce the development of new psoriatic lesions or can precipitate the pre-existing disease. The strongest association has been seen with lithium, NSAIDs, antimalarials, beta-blockers, and tetracyclines. Other drugs include valproic acid, carbamazepine, angiotensin-converting enzyme inhibitors, digoxin, morphine, etc.[51]

Trauma – Koebner's phenomenon i.e. development of isomorphic lesions at the sites of trauma in uninvolved skin is reported in 11-75% of the cases with psoriasis. It occurs more frequently in unstable psoriasis and in the winter months.[52] Various physical insults triggering Koebner's phenomenon include trauma, insect bite, allergic and irritant reactions, etc.[53]

Infections – Tonsillar streptococcal infection is a known factor associated with guttate psoriasis. Apart from streptococcal superantigens, candida albicans, human immunodeficiency virus, and S. aureus cause polyclonal activation of T lymphocytes.[54] Streptococcal M protein triggers the exacerbation of psoriasis due to its homology with human epidermal keratin.[55] In a study conducted by Thorleifsdottir et al., patients reported sustained clinical improvement as well as a reduction in the severity of chronic psoriasis following tonsillectomy because effector T cells generated by palatine tonsils recognize keratin determinants in the skin.[56]

Stress – Stress is known to increase disease severity. Persistent psychological stress lowers serum cortisol levels due to altered hypothalamic-pituitary-axis activity.[57]

Diet – Alcohol abuse is highly prevalent in psoriatic patients and is considered a risk factor for disease exacerbation because of its stimulatory effect on human keratinocytes due to increased production of inflammatory cytokines like keratinocyte growth factor and cyclin D1.[58] A study conducted by Gupta et al. reported a significantly higher risk of severe psoriasis in patients consuming more than 10 cigarettes per day.[59] Smoking results in the stimulation of MAPK and NF-κB and modifies the expression of HLADQ*0201, HLA-Cw6, and CYP1A1.[60]

Role of adaptive and innate immunity

Psoriasis is believed to be an immune-mediated disease because immune cells, primarily activated T cells and the cytokines they release are responsible for inflammation in psoriasis.[61] Naïve T cells differentiate into Th17 cells in the presence of TGF-β and IL-6 which after entering circulation extravasate through endothelium to produce

Th1-Th2-Th17 imbalance at the sites of inflammation.[62] IL-23 produced by macrophages and dendritic cells activate Th17 cells to produce IL-17 and IL-22.[63]

IL-17 is the main cytokine involved in the pathogenesis of psoriasis. IL-17A is produced by Th17 cells and γδ T cells, whereas IL17C is produced by keratinocytes. These cytokines stimulate keratinocytes leading to the production of antimicrobial peptides, β-defensins and chemokines (IL-8, CCL20 and CCL2). IL-17 also maintains mucocutaneous immunity.[64,65]

In addition to Th-17 cells, Th-22 cells on activation by TNF-α, IL-6 and CCL20, produce IL-22 which is involved in epidermal immunity and remodeling. Levels of angiogenic factors such as vascular endothelial growth factors are raised in lesions of psoriasis which results in angiogenesis and abnormal dermal vascular proliferation.[66] High levels of IL-6 in psoriasis suppress regulatory T cells which results in an unopposed activity of pathogenic T cells. γδ T cells and natural killer cells are innate immune cells that act as a first-line defense against pathogens. They maintain inflammation via mediators and amplify adaptive immune response important for the pathogenesis of psoriasis.[67]

Role of the impaired skin barrier in psoriasis :

Skin being the largest organ provides the protective barrier maintained by keratinocytes of the epidermis and lipid-rich matrix. This is mainly localized to the stratum corneum. It provides the first-line defense against microorganisms with the help of antimicrobial peptides.[68] Increased expression of early differentiation markers such as corneodesmosin, cystatin A transglutaminase 1, and decreased late differentiation markers such as loricrin & filaggrin leads to aberrant cornified envelope formation thus abnormal keratinization. This ultimately leads to increased transepidermal water loss which is proportionate to clinical severity. Also, there is decreased expression of aquaporins, a family of water transporting proteins in lesional and perilesional skin in psoriasis.[69] It is reported that deletions of LCE3B

and LCE3C genes, part of the epidermal differentiation complex lead to incomplete barrier repair after minor trauma, which causes the penetration of various antigens and induces an inflammatory response.[70]

Clinical types of psoriasis

Psoriasis can be classified into different clinical types-[71]

- ❖ Plaque psoriasis
- ❖ Guttate psoriasis
- ❖ Flexural/ inverse psoriasis
- ❖ Erythrodermic psoriasis
- ❖ Pustular psoriasis
- Generalized pustular psoriasis (GPP)
  - Acute GPP (Von zumbusch type)
  - Impetigo herpetiformis
  - Infantile/ juvenile pustular psoriasis
- Localized pustular psoriasis
  - Palmoplantar pustular psoriasis
  - Acrodermatitis continua of Hallopeau

Plaque psoriasis

It is also known as psoriasis vulgaris. It is the most common form accounting for 90% of all the cases.[2] Lesions are characterized by well-defined plaques, variably sized, red or salmon pink in color covered with silvery white scales. These plaques are often present in symmetrical distribution mainly involving the extensor aspect of knees and elbows, scalp, umbilicus, and lumbosacral region. If less than 10% of the BSA is involved it is classified as mild to moderate disease which accounts for 80% of the cases. Rest involving larger BSA are known to have moderate to severe disease.[72]

Psoriasis can be associated with symptoms like intense burning and pruritus.[9] Active lesions of plaque psoriasis show Koebner's phenomenon.[52]

Variants of plaque psoriasis :

Scalp psoriasis - scalp is the first and most commonly involved anatomical site associated with itching and scaling. Lesions may extend beyond the hairline and predominantly involve the posterior auricular region and occipital region.[73]

Sebopsoriasis – It is called so because the pattern of distribution is similar to that of seborrheic dermatitis. Sites involved include nasolabial folds, nose, medial cheeks, ears, eyebrows, scalp, and hairline. It can occur alone or coexist with plaque psoriasis. It manifests as thin, well-demarcated, erythematous plaques with variable scaling.[74]

Palmoplantar psoriasis- It is characterized by erythematous, scaly plaques involving palms and soles. It may either occur alone or may coexist with plaque psoriasis.[75]

Guttate psoriasis

Guttate is derived from the Greek word *gutta* meaning droplet. It accounts for 2% of all cases of psoriasis and commonly affects children and young adults. It is characterized by the sudden appearance of widely distributed small, 2 to 10 mm in diameter, scaly erythematous plaques affecting mainly trunk and proximal extremities.[76] Flares of guttate psoriasis can occur in a known case of psoriasis vulgaris. Streptococcal throat infection, rise in anti-streptococcal serum titre, or acute stressful event can be seen prior to the development of skin lesions.[54]

Flexural psoriasis

It is also known as inverse or intertriginous psoriasis and it accounts for nearly 2-7% of all cases of psoriasis.[77] It affects skin folds including the axilla, groins, inframammary region, and perineal area. Lesions are characterized by well-demarcated shiny and erythematous plaques

which lack scaling due to high moisture content in the skin folds, Lesions may be associated with fissuring and maceration.[74]

Erythrodermic psoriasis

It is a life-threatening form of psoriasis which results due to total or subtotal skin involvement. It affects approximately 1% of the total cases.[78] It can occur in two forms. Firstly, it is seen in 20% of the patients with preexisting plaque psoriasis in which plaques coalesce to develop into extensive disease. Secondly, it is seen in patients with unstable psoriasis where it gets precipitated by triggering factors such as sudden withdrawal of potent topical or systemic corticosteroids, infections, tar, and antimalarials.[9,79] Patients of erythrodermic psoriasis complain of severe itching, pain and scaling which affects almost the whole of the body. It results in loss of barrier and thermoregulatory function of the skin leading to dehydration, fluid loss, fever, hypothermia, high output cardiac failure, and shock. The risk of acquiring sepsis, particularly staphylococcus sepsis is high in these patients. Thus, the condition is associated with significant morbidity and mortality.[80]

Pustular psoriasis

Generalized pustular psoriasis

- **Acute generalized pustular psoriasis (von zumbusch type) -** It is an unstable disease characterized by the widespread development of sterile pustules on erythematous skin. These pustules may become confluent to form lakes of pus and even involve mucosal surfaces. An acute attack is precipitated by sudden cessation of systemic corticosteroids and infections.[81] Due to extensive involvement, skin loses its protective and thermoregulatory function which results in fever, loss of electrolytes, proteins & iron, fluid loss, hypovolemia and shock. The patient presents with leukocytosis with neutrophilia, raised erythrocyte sedimentation rate, and deranged liver function

tests. This condition requires hospital admission for management. Complications include sepsis, pneumonitis, and acute respiratory distress syndrome which may even result in death.[82,83,84]

- **Impetigo herpetiformis -** Also known as pustular psoriasis of pregnancy typically affects pregnant women in the third trimester. It is associated with systemic symptoms. It can be fatal to both the mother and fetus if left untreated.[85]

- **Infantile/ juvenile pustular psoriasis –** It is a rare form seen in children. It can occur at any age. It may present as von zombusch pattern, subacute benign annular pattern or a mixed pattern.[86]

Localized pustular psoriasis

It is further classified into two main clinical types :

- **Palmoplantar pustulosis –** It is characterized by recurrent, sterile, pustular eruptions limited to palms and soles. These pustules usually develop around the sides of the heels and the base of the thumb. With time these pustules turn brown in color and start peeling off. It usually affects people between 30-40 years of age with a female preponderance (female to male ratio is 9:1).[87] This condition is associated with severe pain and worsens the quality of life of patients. It is strongly associated with cigarette smoking as compared to plaque psoriasis as around 95% of the patients have a history of smoking.[88,89] Nearly 25% of the cases have been associated with chronic plaque psoriasis.[90]

- **Acrodermatitis continua of Hallopeau –** It is a chronic condition that starts at the tip of the digit following local trauma

or infection. Here, pustules develop on fingers and toes. If not treated properly, it can lead to onychodystrophy, anoychia, osteitis, and osteolysis of distal phalanges.[91]

Nail psoriasis

Nail changes can be seen in any type of psoriasis. Nail changes are present in up to 50% of psoriasis patients and up to 90% of patients with psoriatic arthritis. Fingernails are involved in 50% of the patients compared to toenails which are involved in 35% of the patients.[13,72] There are two patterns of nail changes. Nail matrix involvement presents as pitting, leukonychia, red lunula, and crumbling. Nail bed involvement presents as onycholysis, subungual hyperkeratosis, salmon patch or 'oil drop' spots, and splinter hemorrhages. Nail psoriasis indicates severe psoriasis and joint involvement.[92]

Though a number of other dystrophic nail changes can also occur, the most common nail change is pitting. It presents as multiple superficial depressions due to a defect in nail formation in the proximal nail matrix. Nail psoriasis is a persistent condition that is very difficult to treat.[93]

Mucosal lesions

Apart from skin, nail and joint involvement, psoriasis can also have various oral manifestations such as fissured tongue, geographic tongue, physiologic melanin pigmentation, and leukoedema.[94] Also, cases of oral mucosal psoriasis proven by histopathology are being reported.[95]

Ocular lesions

Approximately 10% of psoriasis patients have ocular findings. Mostly these are found in patients with psoriatic arthritis.[96] The most common eye changes include conjunctivitis, blepharitis, iridocyclitis, and keratitis. It can affect any part of the eye. Other ocular findings include uveitis, birdshot chorioretinitis, inflammatory ectropion associated with madarosis, and trichiasis.[97]

Psoriatic arthritis

Psoriatic arthritis (PsA) is a chronic, inflammatory skeletal disease seen in 6 - 39 % of patients with psoriasis [98] It belongs to a group of diseases called seronegative spondyloarthropathies. It affects both males and females equally usually between 40-50 years of age. PsA can either precede or succeed in the development of skin lesions and can even begin simultaneously.[15] The risk of PsA increases by 2.24 times if more than three sites are affected by psoriasis. Dactylitis is a common feature, in which the entire digit becomes swollen, often called a sausage digit. [99] About 80% of the patients with PsA have associated nail changes as compared to 40% in the patients with psoriasis without psoriatic arthritis.[100]

In a study conducted by Pattison et al. on the prevalence of environmental risk factors, they found physical trauma, oral ulcers, rubella vaccination, and moving to a new house to be associated with PsA.[101]

Based on Moll and Wright criterion, PsA is classified into five subgroups :[15]

	No. of cases (%age)
1. Asymmetrical oligoarthritis (Most common form)	70%
2. Symmetrical polyarthritis resembling rheumatoid arthritis	15%
3. Predominant distal interphalangeal joint involvement	5%
4. Axial spondyloarthropathy resembling ankylosing spondylitis	5%
5. Arthritis mutilans – a destructive form of arthritis	5%

Various imaging modalities for the diagnosis of PsA include X-ray, ultrasonography, magnetic resonance imaging, and computed tomography. [102]

Severity of psoriasis

PASI (Psoriasis Area Severity Index) is the most commonly used tool to classify psoriasis on the basis of severity and to evaluate the efficacy of the treatment. [103] It was created by Fredriksson and Pettersson in 1978.[104]

Psoriasis can be classified into mild, moderate, and severe on the basis of the PASI score (Psoriasis area severity index). PASI score is calculated by estimating BSA (body surface area) for head and neck, trunk, upper extremities, and lower extremities and graded from 0-6 (0 for no and 6 for > 90% BSA involvement) with a correction factor of 0.1, 0.2, 0.3, 0.4 for these regions respectively. Erythema, desquamation, and induration are then graded (0-4) in each region i.e. 0 for no and 4 for very severe involvement. The severity rating for the three main target symptoms is multiplied by the numerical value of the areas involved and by the various percentages of the four body areas. The index varies in steps of 0.1 units from 0.0 to 72.0.[105]

PASI score of <10 is considered mild, 10-20 as moderate, and >20 as severe psoriasis.[106] Although, PASI has been used practically to measure the severity of the disease, it has its own limitations of being too complicated and time-consuming.[103]

Diagnosis of psoriasis

Diagnosis of psoriasis is mainly clinical. Characteristic lesions include sharply demarcated, erythematous plaques covered with silvery white scales. On scrapping these scales become prominent which is known as the 'Grattage test'. On further scrapping when the scale is removed, pinpoint bleeding may be seen. This is known as the 'Auspitz sign.'[107]

In cases with an atypical presentation, a skin biopsy may become necessary.

Histopathology

Classical histopathological features of plaque psoriasis are hyperkeratosis, parakeratosis, acanthosis, absence of granular layer, dilated and tortuous vessels, and leukocytic infiltrate. Skin biopsy of uninvolved skin shows normal histology. [108]

Two key features are hyperproliferation and abnormal differentiation of keratinocytes seen histologically as hyperkeratosis and elongated rete ridges which are club-shaped. Dermal papillae capillaries are dilated and tortuous. Suprapapillary thinning is noted. There's increased

mitosis within the basal and suprabasal layer. Granular layer undergoes terminal differentiation resulting in parakeratosis. Epidermis and dermis show mononuclear leukocytic infiltrate predominantly lymphocytic. 'Munro's microabscesses' i.e. foci of neutrophils within the stratum corneum and 'spongiform pustules of Kojog' i.e. neutrophilic micropustules in stratum spinosum are the key histological features. Depending on the stage of the psoriatic lesion, histopathological features vary.[109]

Pustular psoriasis is characterized by the presence of intraepidermal pustules which are analogous to spongiform pustules of Kogoj. Mixed dermal infiltrate and munro's microabscesses also can be seen. In erythrodermic psoriasis, multiple biopsies could also be required as histopathological findings are non-specific. However, common findings include the absence of horny layer and dilatation of dermal vasculature.[110]

Differential diagnosis

There are multiple conditions that mimic psoriasis and make diagnosis difficult. These include :[108,111]

Plaque psoriasis	• Pityriasis rubra pilaris • Pityriasis rosea • Tinea corporis • Lichen simplex chronicus • Atopic dermatitis • Nummular dermatitis • Mycosis fungoides • Drug eruptions
Scalp psoriasis	• Seborrheic dermatitis • Tinea capitis

Palmoplantar psoriasis	• Contact dermatitis or hand dermatitis • Lichen planus • Lichen simplex chronicus • Secondary syphilis
Inverse psoriasis	• Bacterial or fungal infections • Hailey-Hailey disease • Darier disease • Langerhans cell histiocytosis
Guttate psoriasis	• Pityriasis rosea • Pityriasis lichenoides chronica • Tinea versicolor • Secondary syphilis • Lymphomatoid papulosis
Pustular psoriasis	• Acute generalized exanthematous pustulosis (AGEP) • Subcorneal pustulosis • Dyshidrotic eczema • Irritant dermatitis • Folliculitis • Contact allergic dermatitis • Stevens-Johnson syndrome (SJS) or toxic epidermal necrolysis (TEN)
Erythrodermic psoriasis	• Cutaneous T-cell lymphoma • Drug eruptions • Atopic dermatitis • Congenital ichthyosis • Bullous dermatosis • Pityriasis rubra pilaris

Nail psoriasis	• Alopecia areata • Contact dermatitis • Onychomycosis • Contact dermatitis • Trauma

Psoriasis : Comorbidities

As per World Health Organization (WHO), while the prevalence of vascular lesions and coronary artery disease is highest in diabetes and hypertension, psoriasis is associated with the highest mortality. This could be because, in contrast to diabetes and hypertension, psoriasis isn't generally considered a risk factor for vascular lesions, and is therefore overlooked and frequently untreated. However, studies have shown psoriasis to be associated with various comorbidities. They have also demonstrated the association between Psoriasis Area and Severity Index (PASI) and comorbidities.[112]

Metabolic syndrome

Metabolic syndrome consists of a group of risk factors that include obesity, hypertension, dyslipidemia, and insulin resistance. An association between the severity of psoriasis and metabolic syndrome has been confirmed by a population-based study conducted in the United Kingdom. Metabolic syndrome is considered a strong risk factor for the development of cardiovascular disease.[113]

Obesity

A study conducted by Setty et al. showed that weight gain and fat were risk factors for psoriasis development. Also, the relative risk of development of psoriasis was 2.69 in patients with BMI ≥ 35 kg/m^2 as compared to lean patients.[114] Therefore, preventing weight gain, maintaining a normal weight, and reduction in BMI can reduce the

incidence of psoriasis. Thus, a hypocaloric diet is suggested for obese patients with psoriasis.[115] Adipose tissue secretes pro-inflammatory mediators like resistin and leptin which are found in high levels in obese psoriatic patients. These inflammatory mediators could be related to the worsening of psoriasis.[116]

Hypertension

Studies have shown a positive association as well as a higher incidence of psoriasis among hypertensive patients. Hypertension is a known risk factor for cardiovascular disease and contributes to the development of stroke, myocardial ischemia, infarction, and cardiovascular death.[117,118] Hypertension is additionally an adverse effect of cyclosporine therefore, it should be used cautiously in patients who are known hypertensives.[119]

Diabetes

Psoriasis is related to an increased risk of diabetes. In a study conducted by Ikumi et al. including type 2 diabetes patients, blood glucose level, glycosylated hemoglobin (HbA1c), and skin severity were found to be highly correlated with psoriasis via IL-17.[120] Thus, the management of diabetes is vital in the treatment of psoriasis.

Dyslipidemia

Patients with psoriasis have decreased levels of high-density lipoproteins (HDL) and increased levels of low-density lipoproteins (LDL), very low-density lipoproteins (VLDL), and triglycerides. HDL has anti-oxidant and anti-inflammatory properties resulting in reduced T cell activation. Whereas LDL accumulates in blood vessels and generates active oxygen leading to impaired endothelial function and increased levels of TNF-α in severe psoriasis.[121-123]

Cardiovascular disease

In a large population-based cohort study performed by Gelfand et al., he concluded that severe psoriasis was an independent risk factor for

myocardial infarction (MI).[124] The prevalence of cardiovascular risk factors, including hypertension, diabetes mellitus, obesity, and dyslipidemia is increased in patients with psoriasis. Systemic inflammation in psoriasis induces endothelial dysfunction and insulin resistance. Large amounts of adipokines and chemokines produced by visceral fat are known to stimulate atherosclerosis.[125]

Atherosclerosis is a vital pathological change preceding the development of stroke and MI. There's a positive correlation between arterial stiffness and the duration of psoriasis.[126] Patients with psoriasis show greater aortic vascular inflammation on positron emission tomography/computed tomography (CT).[127] Studies have shown increased prevalence and severity of coronary artery atherosclerosis and calcification in patients with psoriasis as compared to healthy controls.[126,128] Additionally, the thickness of epicardial fat tissue is found to be greater in patients with psoriasis, which is associated with the development of atherosclerosis and increased risk of cardiovascular disease.[129-130]

Non-alcoholic fatty liver disease (NAFLD)

Non-alcoholic fatty liver disease is the deposition of fat within the liver in the absence of significant alcohol intake or use of the drug which facilitates steatosis such as methotrexate, steroids, tamoxifen, or amiodarone.[131] The prevalence of NAFLD in psoriasis is 17-60% and is even higher in cases with severe psoriasis and psoriatic arthritis.[132]

In a study conducted by Gisondi et al. on a series of 130 psoriasis patients, they reported a higher rate of ultrasound-diagnosed NAFLD (47%) as compared to 28% in 260 healthy controls which were matched for age, sex, and BMI.[133] Peripheral insulin resistance and chronic inflammation are the pathogenic links between psoriasis and NAFLD. IL-17 synthesized by T cells in adipose tissue regulates glucose metabolism and lipogenesis and accelerates the progression from simple to severe steatohepatitis.[134] Thus, hepatotoxic drugs such as methotrexate and acitretin should be used very cautiously in

patients with psoriasis due to the greater possibility of NAFLD in these patients.

Inflammatory Bowel Disease (IBD)

The risk of developing psoriasis in a patient with Crohn's disease is 2.9 times higher than in the general population. Also, patients with Crohn's disease have a seven times higher risk of developing psoriasis.[135-136] High rate of comorbidities including thyroiditis, seronegative arthritis, diabetes, and lymphoma were reported by Binus et al. in patients with coexisting psoriasis and IBD as compared to patients with psoriasis alone. This can be explained on the basis of shared genetic risks and common inflammatory pathways between these two diseases.[137]

Chronic kidney disease

Studies suggest an increased risk of chronic kidney disease and end-stage renal disease among patients with psoriasis. Therefore, close monitoring of renal function should be done in patients with psoriasis and nephrotoxic drugs such as cyclosporine should be used cautiously. Glomerulonephritis, commonly IgA nephropathy, membranous nephropathy, and focal segmental glomerulosclerosis can coexist with psoriasis. Various postulated immunologic mechanisms include T cell defects and increased levels of immune complexes leading to glomerular injury. Raised levels of uric acid can also lead to tubular injury in patients with psoriasis.[138-139]

Cerebrovascular disease

Cerebrovascular accidents are commonly seen in psoriatic patients.[140] During ischemia, activation of microglia in the brain is characterized by inflammatory cytokines and neuroprotective mediators.[141] During the early stages of infarction, macrophages infiltrate the brain whereas neutrophils and lymphocytes bind during the late stage.[142] Macrophages secrete IL-23 which causes the proliferation of γδ T and Th17 cells to produce IL-17, thus contributing to post-stroke brain

injury.[143] It has also been observed that patients with psoriasis are at higher risk of developing Parkinson's disease.[144]

Chronic Obstructive Pulmonary Disease (COPD)

Prevalence of COPD was found to be significantly higher i.e. 5.7% in patients with psoriasis as compared to 3.7% in the control group in a case-control study conducted in Israel. Therefore, patients with psoriasis should be advised to stop smoking to avoid additional risk factors leading to COPD.[145]

Obstructive Sleep Apnea/Hypopnea (OSAHS) syndrome

As per the available data, patients with psoriasis have a higher prevalence of OSAHS as compared to patients with chronic bronchitis or with other skin conditions. Increased prevalence of obesity among psoriasis patients is thought to be a responsible factor.[146,147]

Infection

Psoriasis is associated with an increased risk of infections including pneumonia which is attributable to both psoriasis and the immunosuppressive drugs used in the treatment of moderate to severe psoriasis.[148-149] Most serious and common infections among patients with psoriasis are respiratory infections which makes influenza and pneumococcal vaccination important.[149,150] Patients who are on immunosuppressive therapy or have started within one month should not be administered live vaccines.[151] Other infections occurring due to immunosuppressive drugs include herpes zoster, HIV, viral hepatitis B & C, and tuberculosis. Therefore screening for these should be done before initiating immunosuppressive therapy.[152-154]

Malignancy

In a study conducted by Gelfand et al., patients with psoriasis were found to have three times higher risk of developing lymphomas.[155] Risk is significantly enhanced in patients with severe psoriasis or those receiving high cumulative doses of methotrexate or on treatment with

TNFα inhibitors.[156,157] In a population-based study done by Brauchli et al., patients with psoriasis were found to have a higher risk of developing pancreatic cancer and cancer of the hematopoietic system. Risk of developing bladder, kidney, and colon cancer increases in patients with long-standing diseases.[158] Also, white people who receive more than 250 sessions of PUVA therapy have a fourteen times higher risk of developing squamous cell carcinoma as compared to those receiving fewer sessions.[159] High doses of cyclosporine and methotrexate can also induce carcinogenesis.[160]

Psychological and Psychiatric disorders

Patients with psoriasis have increased risks of depression, anxiety, and suicidality. Patients with psoriasis experience a reduction in quality of life. It is either similar to or even worse than patients with other chronic diseases like diabetes, ischaemic heart disease, etc.[161] Patients feel stigmatized leading to depression and suicidal tendencies found in more than 5% of the patients.[162]

About one-third of the patients suffer from pathological worry and anxiety.[163] Avoidance behavior and the belief that they are being judged on the basis of their skin condition are the major contributors to stress. Stress also negatively affects the response to treatment.[164] Abnormal neuroendocrine responses to stress contribute to the pathogenesis of chronic diseases.

Patients with severe psoriasis should be screened for depression and suicidal risk. Patients on acitretin and apremilast should be monitored for mood instability and depression. Psychological intervention in the form of cognitive behavioral therapy along with pharmacological therapy can result in significant improvement in the disease severity.[165]

Erectile dysfunction

Patients with psoriasis especially those with genital lesions have a higher prevalence of sexual dysfunction. It has a deleterious effect on the sexual life of the patients.[166] Incipient pelvic atherosclerosis can

also lead to erectile dysfunction.[167] Drugs like methotrexate and retinoids also lead to decreased libido and erectile dysfunction.[168-169]

Uveitis

The prevalence of uveitis is around 2% in patients with psoriasis.[170] It is associated with male sex, late-onset disease, pustular psoriasis, and HLA-B27. Though it is not frequently seen, however, if untreated it can lead to complications like hypopyon, retinal vasculitis, and posterior synechiae. Therefore, a routine ophthalmological examination should be done in these patients.[170-171]

Osteoporosis

In a study conducted by Hofbauer et al., reduced bone density was reported in one-third of patients with psoriatic arthritis and men were six times more affected by osteoporosis.[172] Loss of bone density correlates with the duration and severity of disease and the number of affected joints.[173]

Psoriasis and uric acid

Uric acid is a heterocyclic compound of carbon, oxygen, nitrogen, and hydrogen. It is the end product of endogenous and exogenous purine metabolism. The liver and gut, lungs, kidneys, muscles, and vascular endothelium are the main sites of uric acid production.[174] Normal serum uric acid levels in adult males are 3.4-7mg/dl whereas in adult females it is 2.4-5.7mg/dl.[21] Hyperuricemia is defined as serum uric acid levels greater than 6mg/dl in females and greater than 7mg/dl in males.[22]

Urate homeostasis is maintained by a balance between its production and excretion. Kidneys are mainly responsible for UA excretion accounting for 65-75% of UA elimination. Intestines are also responsible for 25-35% of UA elimination. Kidneys and intestine cause excretion through urate transporters present on their surface. Primary urate transporters are urate transporter 1 (URAT1), located on the apical surface of proximal tubular cells, ATP-binding cassette subfamily

G member 2 (ABCG2), located on both intestinal and renal cells surface**,** and glucose transporter 9 (GLUT9), located on the basolateral membrane of the proximal tubule.[175]

Urate secretion is mediated by organic anion transporters (OAT1, OAT2, and OAT3) at the basolateral membrane, sodium-dependent phosphate cotransporters (NPT1 and NPT4)**,** and multidrug resistance protein-4 (MRP4) at the apical membrane. URAT 1, OAT4**,** and GLUT 9 are responsible for tubular urate reabsorption.[176] Elevated SUA levels derive from increased production, impaired elimination, or a combination of two. Hyperuricemia can be classified as renal overload type (overproduction and reduced extra-renal excretion) and renal underexcretion type.[177] Disorders belonging to the first group include malignancy, psoriasis, alcoholism, obesity**,** and genetic disorders whereas diuretics, renal disease**,** and immunosuppressant drugs are included in the second group of disorders.[178]

UA formation involves a series of biochemical reactions leading to the degradation of adenosine and guanosine. In the first step, adenosine monophosphate is converted to inosine by a deaminase that eliminates an amino group creating the inosine monophosphate which is then transformed into inosine by a nucleotidase. Guanine monophosphate is transformed into guanosine by nucleotidase. After this, an enzyme called purine nucleoside phosphorylase converts inosine and guanosine into hypoxanthine and guanine. Xanthine-oxidase transforms hypoxanthine into xanthine and the guanine deaminase will convert guanine into xanthine. Finally, xanthine is oxidized by xanthine oxidase, forming the uric acid molecule.[179] Uric acid is known for its double-faced nature i.e. both as a protective and risk factor.

Uric acid as protective factor

SUA has a strong antioxidant effect as well as metal-chelating properties. It acts as a scavenger of reactive oxygen species and plasma nitrogen radicals, thus reducing the production of peroxynitrite.[180-181] UA also plays an important role as an immune-stimulating agent, especially in innate immune responses and type 2

immune responses.[182] Studies suggest that after transformation in crystals of monosodium urate, UA acts as a damage-associated molecular pattern that activates dendritic cells and enhances the innate immune system.[183]

Monocytes and neutrophils phagocytose urate crystals causing the generation of pro-inflammatory cytokines such as IL-1. Internalization of UA crystals by leukocytes leads to activation of the inflammasome, production of free radicals, and release of cathepsin B.[184]

The protective role of high SUA levels in the development of some neurological disorders such as dementia, Alzheimer's disease, multiple sclerosis, and Parkinson's disease has been hypothesized.[185] Zhou et al. demonstrated a significant inverse association between SUA and Alzheimer's disease or Parkinson's disease in a meta-analysis.[186] Studies have also shown the significant protective role of higher SUA levels in preventing negative neurological outcomes in male patients. It has been speculated that the neuroprotective effect of SUA on brain function and cognitive decline is due to its antioxidant and metal-chelating properties.[187]

Uric acid as risk factor

Apart from its beneficial effects, SUA acts as a risk factor for gout. Gout is caused by the deposition of monosodium urate crystals in tissues leading to arthritis, soft tissue masses (tophi), nephrolithiasis, and urate nephropathy. Elevated serum uric acid levels i.e., hyperuricemia is a biological precursor to gout. Acute gout often presents as attacks of pain, erythema, and swelling of one or a few joints mostly in the lower extremities. Asymptomatic hyperuricemia is common but usually does not progress to clinical gout.[188]

UA is also associated with several cardiovascular disorders. UA upregulates inflammatory signal pathways and promotes the pro-inflammatory response of M1 macrophages inhibiting the anti-inflammatory response of M2 which leads to the development of atherosclerotic lesions.[189] Through endothelial dysfunction,

hyperuricemia leads to the development and progression of atherosclerosis.

Intracellularly, UA decreases the bioavailability of nitric oxide thus impairing the activity of endothelial nitric oxide synthase and nitric oxide production. UA also increases reactive oxygen species (ROS), which in turn causes β-cell apoptosis resulting in insulin resistance. UA favors nitric oxide overproduction by inducing NO synthase (iNOS) gene expression which leads to β-cell dysfunction and apoptosis and reduces glucose-stimulated insulin secretion.[190]

Hyperuricemia is also considered a risk factor for the development of hypertension and chronic kidney disease. By activating the renin-angiotensin system, UA inhibits nitric oxide synthesis and promotes endothelial dysfunction, sodium reabsorption, and proliferation of vascular smooth muscle cells. As uric acid triggers systemic inflammation, secretion of pro-inflammatory cytokines increases leading to increased extracellular fluid volume and vascular resistance, worsening systemic hypertension. Likewise, increased UA levels cause vascular and tubulointerstitial alterations that facilitate the development and progression of chronic kidney disease. Since hyperuricemia is often associated with other cardiovascular risk factors such as obesity, hypertension, and metabolic syndrome, which might contribute to cardiovascular morbidity so the direct cause-effect relationship between hyperuricemia and chronic kidney disease or cardiovascular disease cannot be determined.[191] In a study conducted by S Bo et al., hyperuricemia was associated with early progression of the renal disease more commonly in patients with diabetes.[192]

Pathophysiology of uric acid in psoriasis and psoriatic arthritis

Hyperuricemia is a common finding in psoriasis. The characteristic pathological process in psoriasis involves increased mitotic activity of the basal cell layer resulting in rapid epidermal cell turnover with the 28-day normal epidermal cell cycle reduced to 5 days. The mitotic activity of cells involves purine (adenine and guanine) metabolism, the end product of which is uric acid. Therefore, it is likely that increased

serum uric acid levels in psoriasis are due to enhanced epidermopoiesis with reduced epidermal turnover time. This is similar to hyperuricemia seen in myeloproliferative disorders. Serum uric acid levels are expected to vary with the duration and severity of the disease.[19,193] In a case-control study conducted by Baumann et al. including 76 psoriatic cases and 68 controls, SUA levels in cases were found to be significantly higher than in the controls.[193]

Urate crystals stimulate human keratinocytes to produce several inflammatory cytokines and chemokines, particularly IL-1α and IL-1β, which are involved not only in gouty flares but also in the pathogenesis of PsA. SUA also increases the expression of purinergic receptors P2Y on keratinocytes, stimulating cell proliferation.[194]

Increased production of IL-17 in psoriasis can affect the liver, leading to hepatic complications such as non-alcoholic fatty liver disease. Subsequently, it lowers the hepatic ATP production which in turn causes increased production of UA from the hepatocytes.[195]

A remarkable difference in SUA levels between subjects with psoriasis and controls ($p = 0.04$) was demonstrated in a meta-analysis conducted by Li et al.[196] Similar results were found in a population-based study involving 11,282 participants where authors found that the patients with psoriasis were at an increased risk of hyperuricemia and were more likely to develop gout as compared to subjects without psoriasis.[197]

However, a case-control study by Scott et al. showed contrasting results where no significant difference in SUA levels was found between psoriasis patients and healthy individuals or subjects with contact dermatitis.[198]

Management of psoriasis

Psoriasis is a common chronic skin disorder that requires long-term management, not only because of its prevalence but also because of its profound impact on the quality of life of the patients. For those with localized mild to moderate disease, topical therapy is the mainstay of treatment. Phototherapy is generally used as a first-line treatment for

patients with extensive psoriasis or disabling symptoms. But when phototherapy is ineffective or not feasible, systemic treatments with conventional oral agents or biologics are indicated. The presence of psoriatic arthritis is an indication for systemic therapies in collaboration with a rheumatologist. [199]

Topical therapy

Topical therapy is the mainstay of treatment for disease of limited extent. It includes emollients, corticosteroids, vitamin D and its analogues, retinoids, coal tar, and dithranol.

Corticosteroids: They are considered the cornerstone of topical treatment, as they are often well tolerated and effective for patients with mild psoriasis. There is a wide variety of topical corticosteroid agents that can be classified by potency, formulation (e.g., creams, ointments, lotions, etc.), or the combination of active agents (e.g., clobetasol plus calcitriol). The mechanism of action involves modulation of the skin at various levels, including anti-inflammatory, immunosuppressive, antiproliferative, and vasoconstrictive effects. Topical corticosteroids have three essential effects in the treatment of psoriasis:[200]

1. Localized immune response suppression through a local reduction in cytokines
2. Slows hyperproliferation of keratinocytes
3. Vasodilatory effects

Superpotent (class I) topical corticosteroids are effective treatment for mild to moderate plaque psoriasis whereas low potency cream (e.g., hydrocortisone 1%) is suitable for the face and intertriginous areas. Occlusion of topical steroids increases its penetration and efficacy. There is a risk of cutaneous and systemic side effects associated with long-term usage of topical corticosteroids. These include irritation, burning, atrophy of the skin, telangiectasia, folliculitis, striae, HPA axis suppression, Glaucoma, etc.[201]

Vitamin D analogues : These include calcitriol and its synthetic derivatives calcipotriol and tacalcitol. They bind to vitamin D receptors leading to inhibition of keratinocyte proliferation and enhancement of keratinocyte differentiation. They also exert immunosuppressive properties. To maximize efficacy while reducing the risk of skin atrophy that is associated with chronic corticosteroid use, vitamin D analogues are used in combination with other topical agents including halobetasol propionate, tazarotene, and crude coal tar. Side effects include skin irritation, erythema, burning, hypercalcemia, etc.[202]

Tazarotene : It is a vitamin A-derived acetylene retinoid that selectively binds to the retinoic acid receptors (RARs) β and γ. It has both anti-inflammatory and antiproliferative actions. Tazarotene should be applied directly on the thick and scaly psoriatic lesions and care should be taken to avoid the application on surrounding unaffected skin. It can be teratogenic and the local adverse effects include a burning and stinging sensation, erythema, peeling, and localized edema of the skin. Studies have reported that combining tazarotene with intermediate and superpotent topical corticosteroids leads to more rapid improvement, improved efficacy, and decreased irritation.[203]

Calcineurin Inhibitors (Tacrolimus and Pimecrolimus) : They are commonly used off-label to treat facial and intertriginous psoriasis. They cause the reduction of T-cell proliferation through inhibition of calcineurin, calcium- and calmodulin-dependent phosphatase enzyme. Common side effects include burning and stinging, though can also lead to lymphoma and skin cancer. In an open-label trial conducted by Freeman et al., tacrolimus 0.1% ointment when applied twice daily on face and intertriginous areas for 8 weeks lead to clearance of lesions in 81% of the patients.[204]

Anthralin (Dithranol)

Topical anthralin is used for treating localized plaque psoriasis resistant to other therapies. It is a synthesized version of the natural product

chrysarobin derived from the South American araroba tree. Limited use of anthralin is attributed to its irritant potential and the permanent red-brown staining of clothing with the temporary staining of the skin. Due to these adverse effects, the “short-contact anthralin therapy (SCAT)” is often used in the outpatient setting where 1% or 1.2% anthralin is applied for 5–10 min per day titrating up to 20-30min as tolerated.[205]

Coal tar

In 1925, the Goeckerman regimen was first developed which involves the application of crude coal tar to the entire body, including unaffected areas, for several hours a day along with UVB therapy. Coal tar is an ancient modality which provides provides antipruritic, anti-inflammatory, and anti-psoriatic effects.[206]

Other topical keratolytic agents such as **salicylic acid** and **lactic acid** can also be used for the treatment of psoriasis.

Phototherapy and Photochemotherapy

Phototherapy is the mainstay of treatment with moderate to severe psoriasis especially those not responding to topical agents. It is available as broadband UVB, narrowband UVB (NB-UVB), and psoralen plus UVA (PUVA). In broadband UVB, controlled doses of UVB light from an artificial light source can be used to treat single patches, widespread psoriasis, and psoriasis that resist topical treatments. Narrowband UVB therapy is usually more effective than broadband UVB treatment. It can be given to all patients including children and pregnant women and is usually administered two or three times a week until the skin improves, then weekly sessions are given for maintenance. A combination of UVB treatment and coal tar treatment known as Goeckerman treatment is more effective than either alone because coal tar makes skin more receptive to UVB light.[207]

In photochemotherapy, light-sensitizing medication (psoralen) is taken before exposure to UVA light which makes the skin more responsive to

UVA exposure. The excimer laser is another form of light therapy used for mild to moderate psoriasis where a controlled beam of UVB light of a specific wavelength is directed to the psoriasis plaques to control scaling and inflammation. It treats only the involved skin therefore, healthy skin surrounding the patches isn't harmed.[207]

Systemic therapy

Systemic agents are generally required in patients with moderate-severe psoriasis to achieve adequate disease control.

Acitretin: It is an oral retinoid that is a synthetic derivative of vitamin A which is indicated for the treatment of moderate to severe psoriasis. It has immunosuppressive & anti-inflammatory properties. Also modulates epidermal proliferation and differentiation. Retinoids can be used as an adjunctive therapy e.g. combination retinoid–PUVA therapy to enhance efficacy and minimize side effects. Acitretin is avoided in women of childbearing age due to its teratogenic potential. Common side effects include mucocutaneous dryness, gastrointestinal upset, arthralgia, and photosensitivity. Sometimes, it can cause transaminitis and elevated triglyceride levels.[208]

Methotrexate: It is an inhibitor of folate synthesis and helps psoriasis by decreasing the production of skin cells and suppressing inflammation. It also slows the progression of psoriatic arthritis. Methotrexate is generally well tolerated. However, the risk of hepatic fibrosis increases after a total cumulative dose of 1.5 gm. Other common side effects are nausea, vomiting, fatigue, and diarrhea. In a randomized, double-blind, placebo-controlled study, almost 40% of patients with methotrexate showed 75% improvement in Psoriasis Area and Severity Index score as compared to 18.9% of patients with placebo at 16 weeks.[209]

Cyclosporine: It is a calcineurin inhibitor used for the treatment of moderate to severe psoriasis. It also shows efficacy in psoriatic

arthritis. Due to the rapid onset of action and less concern about myelosuppression or hepatotoxicity it has an advantage over other agents. Side effects are nephrotoxicity, hypertension, hyperkalemia, elevated triglyceride levels, tremors, gingival hyperplasia, and malignancies such as skin cancers and lymphoma. In a 1-year open, multicentre, randomized study with 400 patients, cyclosporine showed significant improvement or complete remission in 80% to 90% of patients within 12 to 16 weeks.[210]

Phosphodiesterase inhibitors: Apremilast is a PDE 4 inhibitor specific to cyclic adenosine monophosphate. It regulates the expression of a number of proinflammatory and anti-inflammatory cytokines, such as IL-17, IL-23, and TNF-α, which are involved in the pathophysiology of psoriasis. The most common adverse effects include diarrhea, nausea, vomiting, etc.[211]

Fumaric acid esters (FAE): Oral FAE produces a beneficial shift towards Th2-like cytokine secretion associated with a reduction in peripheral lymphocytes (primarily T cells) thus inhibiting the proliferation of epidermal keratinocytes in patients with psoriasis. Hematological side effects such as leucopenia, lymphopenia, and eosinophilia, are frequently observed during FAE therapy.[212]

Biologic therapy

Biologics are potential treatment options in those where conventional systemic agents fail to produce adequate response. They include drugs which are proteins produced by living organisms to target specific points of inflammation cascade, which include antibodies against cell surface markers, cytokines, and adhesion molecules. Biologics must be reserved for severe cases of psoriasis and psoriatic arthritis only. All the patients must undergo detailed history, complete physical examination, and laboratory investigations including Complete blood count, liver and renal function tests, screening for tuberculosis, hepatitis, and HIV infection, urine analysis, and chest X-ray. Exclusion

criteria include active tuberculosis, viral hepatitis, HIV positivity, > 200 treatments of PUVA, active infections, pregnancy, breastfeeding, severe congestive heart failure, demyelinating diseases, and premalignant states.[213] Live vaccines should be avoided during the course of biologics. Additional screening for depression should be done with brodalumab.[211]

Tumor necrosis factor alpha (TNFα) inhibitors: TNFα is increased in skin and synovium in psoriatic patients. Thus, anti- TNF α therapy reduces disease activity in psoriasis and psoriatic arthritis. TNFα inhibitors include etanercept, infliximab, adalimumab, and certolizumab. [211]

IL-12/IL-23 p40 inhibitors: Ustekinumab is a humanized IgG1 monoclonal antibody against the p40 subunit that is common to both IL-12 & IL-23. It is approved for patients aged 12 years or older. [211]

IL-23 p19 inhibitors: Guselkumab, tildrakizumab and Risankizumab are humanized IgG1 monoclonal antibodies that selectively bind to the p19 subunit and inhibits IL-23.[211]

IL-17 inhibitors: Ixekizumab and secukinumab inhibit the activity of IL-17A whereas brodalumab inhibits the activity of IL-17 receptor A.[211]

In a randomized control trial conducted by Thaci et al., Secukinumab (79.0%) was found to be superior to ustekinumab (57.6%) as assessed by PASI 90 response at week 16 with a p-value of < .0001. Also, 100% improvement from baseline PASI score at week 16 was also significantly greater with secukinumab (44.3%) than ustekinumab (28.4%) with a p-value of < .0001.[214]

Adverse effects of biologics include injection site reactions (pain, erythema, swelling), serious infections, lymphoma or other malignancies, worsening heart failure and reactivation of tuberculosis or hepatitis B virus, and worsening of IBD.[211]

MATERIAL & METHODS

STUDY DESIGN

This is a case control study of clinically diagnosed cases of psoriasis attending outpatient and inpatient in the Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana. Study was done from 1 March,2021 to 28 February,2022. Ethical committee clearance was obtained and informed consent was obtained in the regional as well as in English language.

INCLUSION CRITERIA:

1. Clinically diagnosed cases of Psoriasis vulgaris
2. Patients of any age group and either sex
3. Patients willing to participate

EXCLUSION CRITERIA:

1. Patients not willing to participate
2. Pregnant and lactating woman
3. Patients with history of leukemia, polycythemia vera, gout, chronic liver disease or renal disorder
4. Patients who were taking drugs known to affect serum uric acid levels such as alcohol, allopurinol, salicylates, ethambutol etc.
5. Patients who were taking or had taken methotrexate in last 3 months

METHODS:

Clinically diagnosed cases of psoriasis attending outpatient and inpatient in Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana during the study period of one year i.e. from 1 March,2021 to 28 February,2022 were included in the study. Detailed history was taken and thorough examination was done. BMI and PASI score were calculated. Blood sample for serum uric acid was taken in plain vacutainer. BMI matched controls equivalent to 1/4th of the total cases were taken. Controls included healthy individuals, healthy attendants of patients, patients of other skin diseases known to have

no effect on serum uric acid levels. Same exclusion criteria was applied to the controls.

Serum uric acid was calculated by enzymatic colorimetric method using uricase enzyme on autoanalyzer. Serum uric acid of the patients was correlated to PASI score, type of psoriasis and was compared with serum uric acid levels of BMI matched controls.

Method to calculate PASI score- To calculate PASI score affected body surface area (BSA) is estimated for the head and neck, trunk, upper extremities and lower extremities separately and graded (0-6) with a correction factor of 10%, 20%, 30%, 40% respectively to allow for the differing surface area of these four regions. Erythema, desquamation and induration are then graded (0-4) in each region. The severity rating for the three main target symptoms is multiplied with the numerical value of the areas involved and with the various percentages of the four body areas. The index varies in steps of 0.1 units from 0.0 to 72.0.[105]

NUMBER OF CASES

Clinically diagnosed cases of psoriasis attending outpatient and inpatient in Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana during the study period of one year i.e. from 1 March,2021 to 28 February,2022 were included in the study.

STATISTICAL ANALYSIS

Data was described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test was performed and exact test was used when the expected frequency was less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

OBSERVATION & RESULTS

This case-control study included clinically diagnosed cases of psoriasis attending outpatient and inpatient in the Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana during the study period of one year i.e. from 1 March,2021 to 28 February,2022. These patients were selected on basis of inclusion and exclusion criteria. BMI matched controls equivalent to 1/4th of the total cases were taken. Serum uric acid was calculated for both the cases and controls and serum uric acid of the patients was correlated to PASI score, type of psoriasis and was compared with serum uric acid levels of BMI matched controls.

AGE DISTRIBUTION OF CASES:

In table 1 and figure 1- The age group of cases varies from 17 years to 66 years, with the maximum number of patients in the age group of 31-50 years (56.67%) followed by 51-60years (18.33%) and the minimum number of patients in the age group of <20 years (1.67%). The minimum age was 17 years and the maximum age was 66 years.

TABLE 1: AGE DISTRIBUTION OF CASES

Age(years)	No. of patients (n)	Percentage (%)
<20	1	1.67%
21-30	9	15.00%
31-40	17	28.33%
41-50	17	28.33%
51-60	11	18.33%
>60	5	8.33%

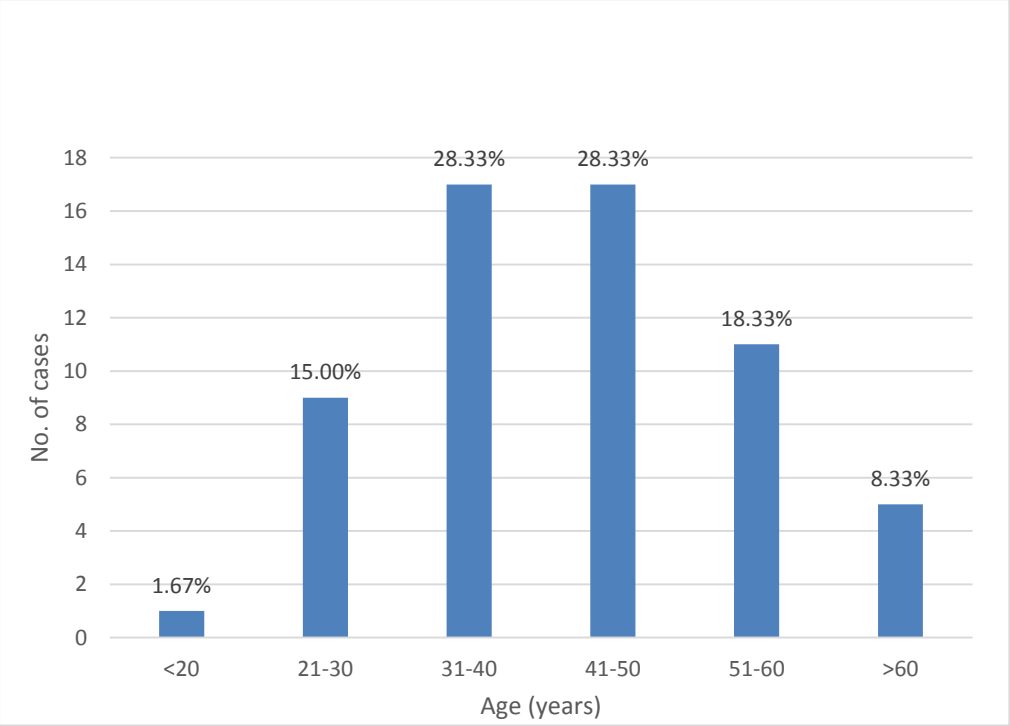

FIGURE 1: AGE DISTRIBUTION OF CASES

AGE DISTRIBUTION OF CONTROLS:

In table 2 and figure 2- The age group of controls varies from 26 years to 68 years, with the maximum number of patients in the age group of 41-50 years (46.67%) followed by 31-40years (20%) and the minimum number of patients in the age group of <30 years (6.67%). The minimum age was 26 years and the maximum age was 68 years.

TABLE 2: AGE DISTRIBUTION OF CONTROLS

Age(years)	No. of controls (n)	Percentage (%)
<30	1	6.67%
31-40	3	20.00%
41-50	7	46.67%
51-60	2	13.33%
61-70	2	13.33%

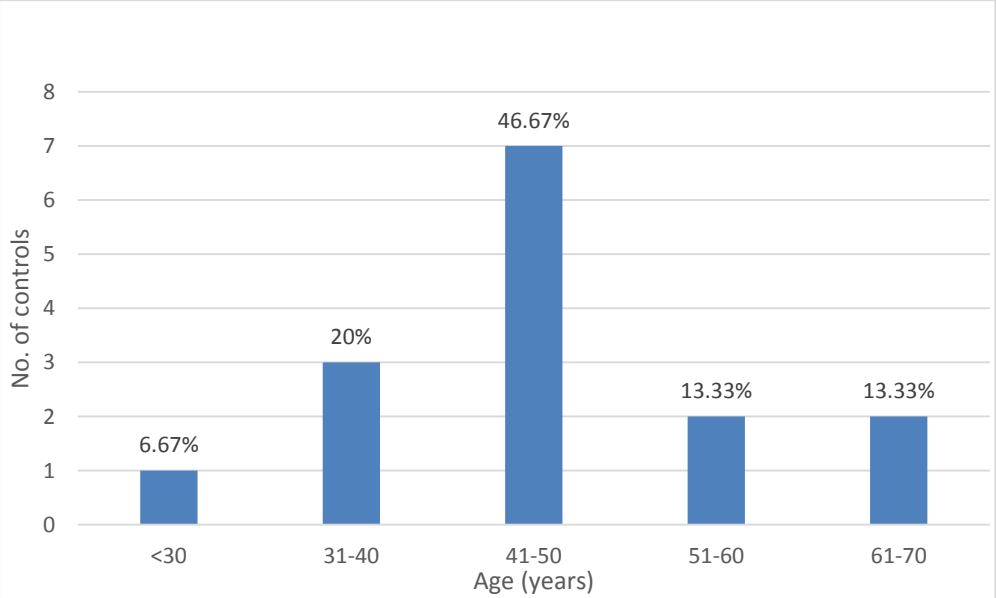

FIGURE 2: AGE DISTRIBUTION OF CONTROLS

GENDER DISTRIBUTION OF CASES:

In table 3 and figure 3- Out of the total 60 cases, 13 (21.70%) were females and 47 (78.30%) were males.

TABLE 3: GENDER DISTRIBUTION OF CASES

Gender	No. of cases (n)	Percentage (%)
F	13	21.70%
M	47	78.30%

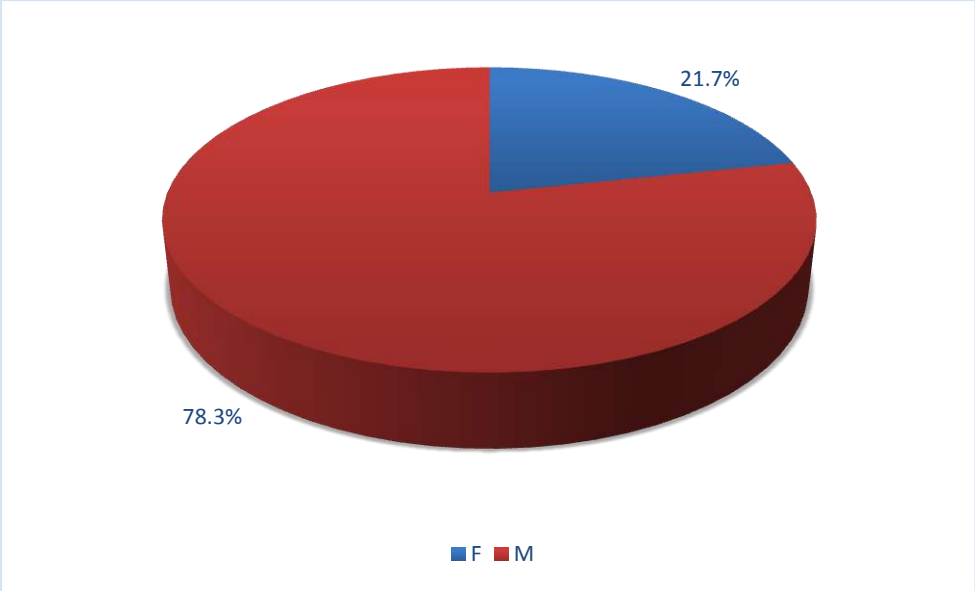

FIGURE 3: GENDER DISTRIBUTION OF CASES

GENDER DISTRIBUTION OF CONTROLS:

In table 4 and figure 4- Out of the total 15 controls, 8 (53.30%) were females and 7 (46.70%) were males.

TABLE 4: GENDER DISTRIBUTION OF CONTROLS

Gender	No. of controls (n)	Percentage (%)
F	8	53.30%
M	7	46.70%

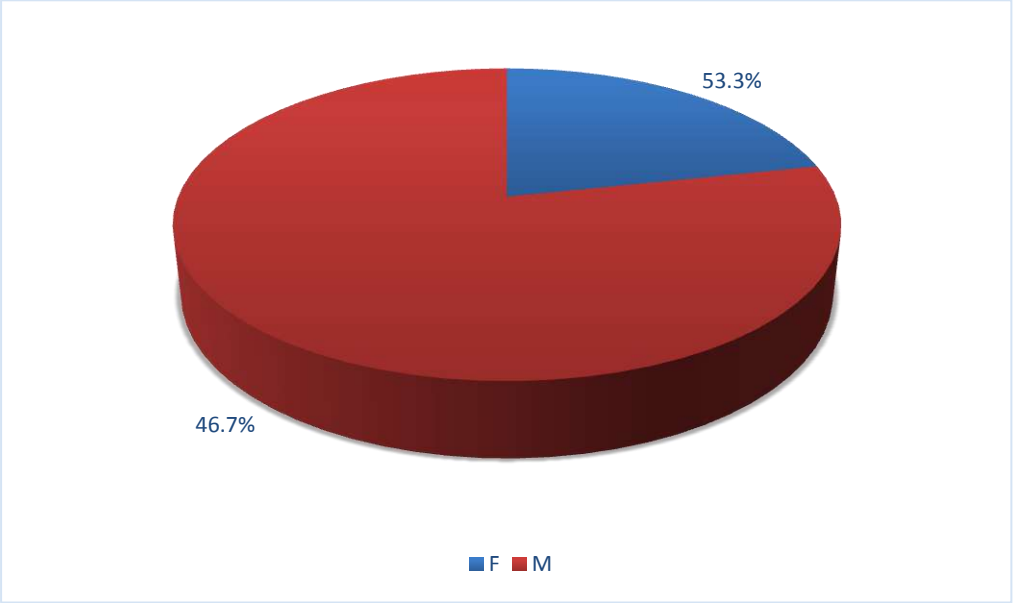

FIGURE 4: GENDER DISTRIBUTION OF CONTROLS

SERUM URIC ACID LEVELS OF CASES AND CONTROLS

Table 5-

- Mean age of cases was 43.05±11.17 years which was comparable to the mean age of controls 46.93±11.23 years (p-value 0.233).
- Mean BMI of cases was 26.24±4.93 kg/m^2 which was also comparable to the mean BMI of controls which was 27.44±3.66 kg/m^2 (p-value 0.381).
- Mean SUA of cases was 5.88±1.67 mg/dl whereas the mean SUA of controls was 5.27±1.19 mg/dl. There was no significant difference between the mean SUA levels of cases and controls in our study (p-value 0.187).

TABLE 5 : SERUM URIC ACID LEVELS OF CASES AND CONTROLS

	Cases		**Controls**	
	Mean	SD	Mean	SD
Age(years)	43.05	11.17	46.93	11.23
Height(m)	1.68	0.13	1.65	0.12
Weight(kg)	74.94	15.57	74.73	13.18
BMI(kg/m^2)	26.24	4.93	27.44	3.66
Serum uric acid (mg/dl)	5.88	1.67	5.27	1.19

TYPES OF PSORIASIS

In table 6 and figure 5 –

- Out of 60 cases, 43 cases had chronic plaque psoriasis (71.70%) followed by palmoplantar psoriasis which was present in 9 patients (15.00%).
- However, the least number of cases belonged to flexural, erythrodermic and guttate psoriasis with one patient each.

TABLE 6 : TYPES OF PSORIASIS

Type of psoriasis	No. of cases (n)	Percentage (%)
CPP	43	71.70%
PP	9	15.00%
SP	3	5.00%
GP	2	3.30%
FP	1	1.70%
EP	1	1.70%
GP	1	1.70%

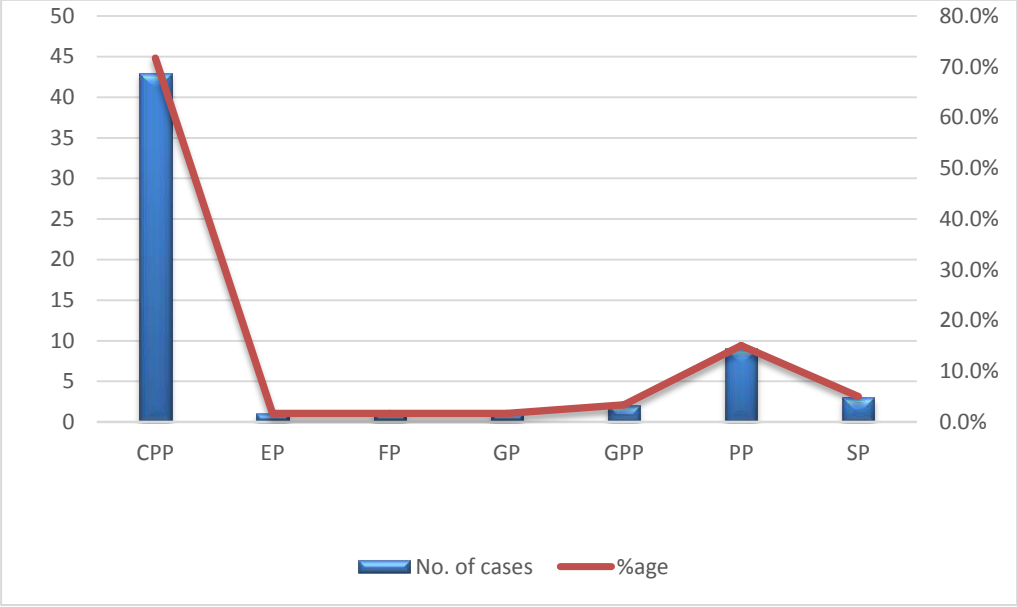

FIGURE 5: TYPES OF PSORIASIS

AGE-WISE DISTRIBUTION OF TYPES OF PSORIASIS

Table 7 and figure 6 –

- Distribution of the types of psoriasis in different age groups was variable such as chronic plaque psoriasis which was the most common type in our study was more in the age group of 31-40 years followed by 41-50 years.
- Palmoplantar psoriasis was common in the age group of 31-50 years and scalp psoriasis was more in 31- 40 years age group.
- The minimum number of cases of psoriasis were recorded in the age group > 60 years.

TABLE 7 :AGE-WISE DISTRIBUTION OF TYPES OF PSORIASIS

Age (years)	Type of psoriasis							Total
	CPP	EP	FP	GP	GPP	PP	SP	
< 30	6	0	0	0	0	0	1	7
31-40	14	0	0	1	0	3	2	20
41-50	12	1	0	0	1	3	0	17
51-60	8	0	1	0	0	2	0	11
> 60	3	0	0	0	1	1	0	5
Total	43	1	1	1	2	9	3	60

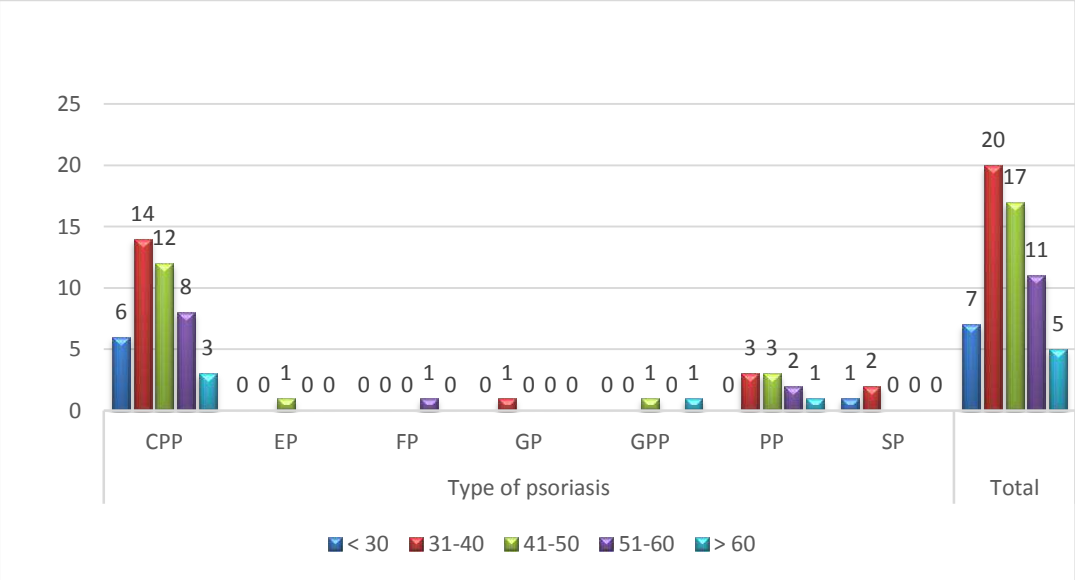

FIGURE 6 :AGE-WISE DISTRIBUTION OF TYPES OF PSORIASIS

GENDER-WISE DISTRIBUTION OF TYPES OF PSORIASIS

Table 8 and figure 7 – Out of 43 cases of chronic plaque psoriasis, 35 were males and 8 were females. Similarly, male preponderance was seen in all other types of psoriasis. Overall in our study psoriasis was predominantly found in males with male : female ratio of 3.6 : 1.

TABLE 8 : GENDER-WISE DISTRIBUTION OF TYPES OF PSORIASIS

Gender	Type of psoriasis							Total
	CPP	EP	FP	GP	GPP	PP	SP	
F	8	0	0	0	1	4	0	13
M	35	1	1	1	1	5	3	47
Total	43	1	1	1	2	9	3	60

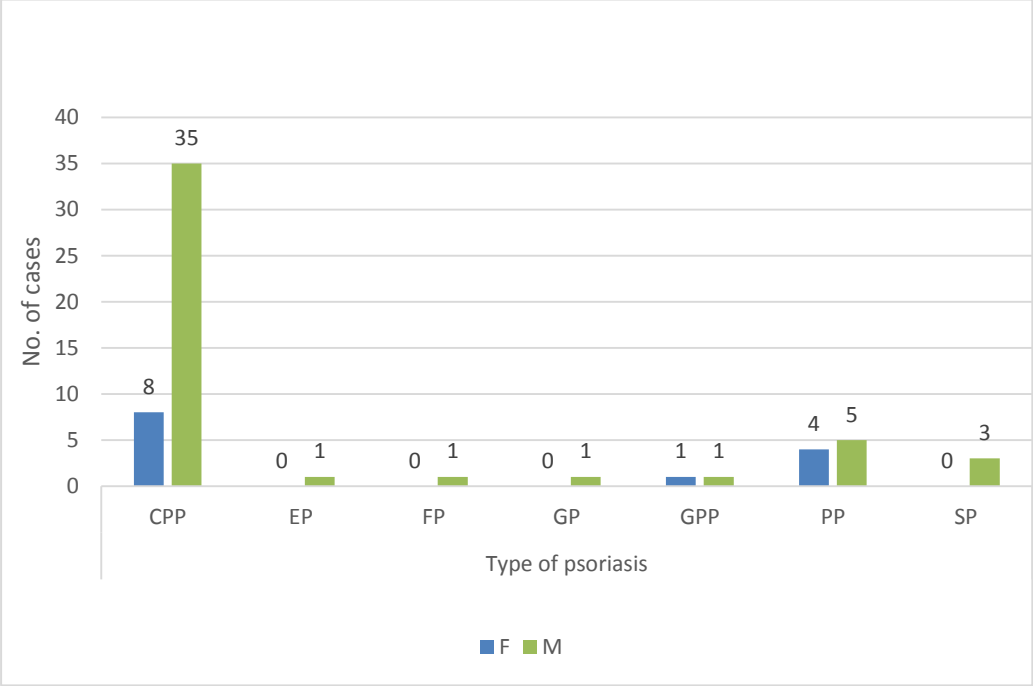

FIGURE 7 : GENDER-WISE DISTRIBUTION OF TYPES OF PSORIASIS

CHIEF COMPLAINTS AS PER TYPE OF PSORIASIS

Table 9 and figure 8 – Out of 43 patients of chronic plaque psoriasis, redness and scaling were the commonest chief complaints reported by 100% of the cases followed by itching and pain in 17 and 18 cases of chronic plaque psoriasis respectively. Similarly, redness and scaling were the common chief complaints in all other types of psoriasis as well.

TABLE 9 : CHIEF COMPLAINTS AS PER TYPE OF PSORIASIS

Chief complaints	Types of psoriasis							Total
	CPP	EP	FP	GP	GPP	PP	SP	
Redness	43	1	1	1	2	5	3	56
Scaling	43	1	0	1	1	8	3	57
Pain	8	0	1	0	1	4	0	14
Itching	17	1	0	0	0	4	1	22

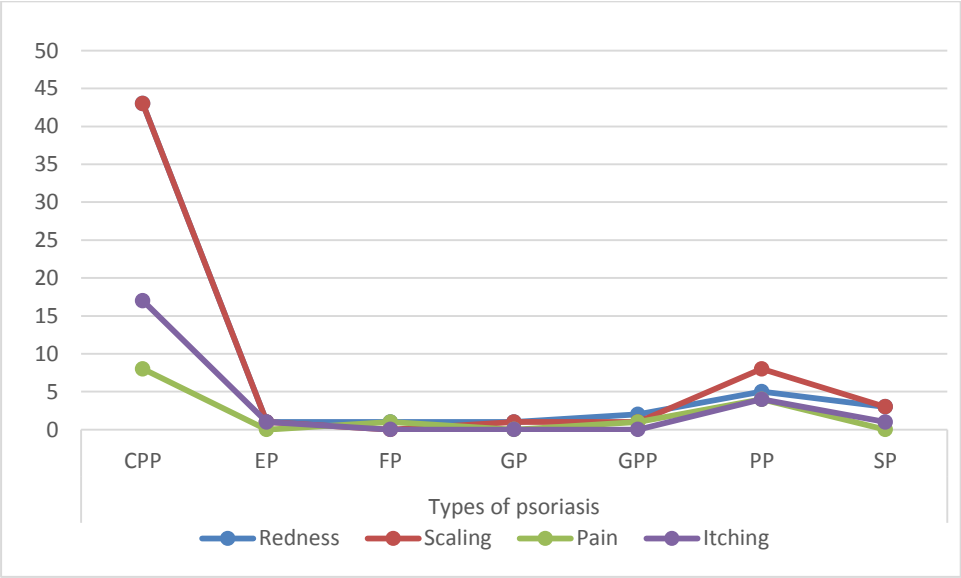

FIGURE 8 : CHIEF COMPLAINTS AS PER TYPE OF PSORIASIS

SITES OF INVOLVEMENT

In table 10 and figure 9 – In our study, extremities including the lower limbs and the upper limbs were the most commonly affected sites involved in 42 cases (70%) and 41 (68.35%) of the cases respectively ; followed by scalp (63.30%) and trunk (60.00%). Exclusive involvement of palms and soles was seen in 15 (25%) cases.

TABLE 10 : SITES OF INVOLVEMENT

Sites	No. of cases (n)	Percentage (%)
Scalp	38	63.30%
Upper limbs	41	68.35%
Trunk	36	60.00%
Lower limbs	42	70.00%
Palms & soles	15	25.00%

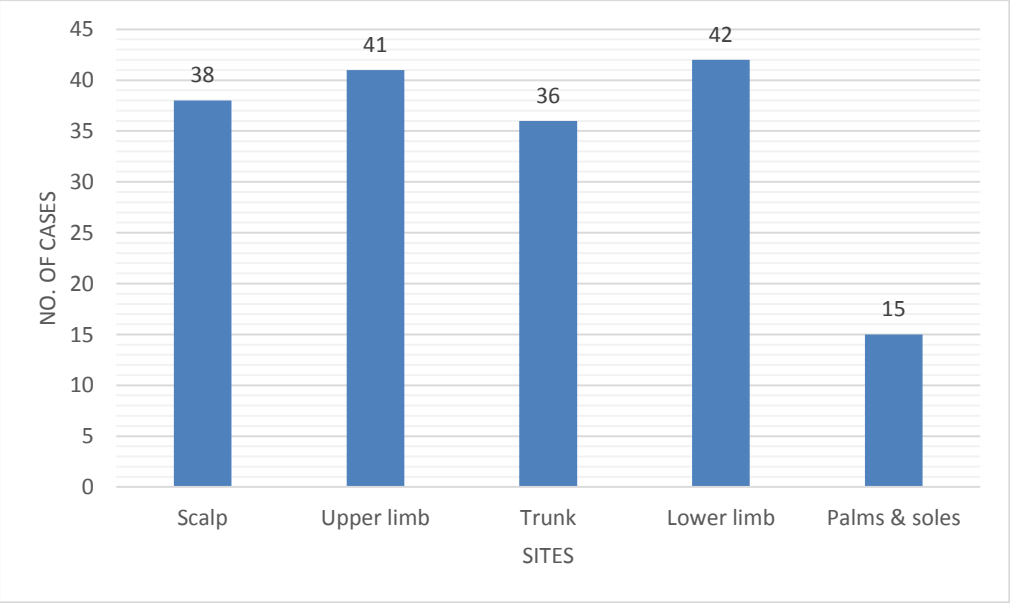

FIGURE 9 : SITES OF INVOLVEMENT

PASI SCORE OF CASES

Table 11 and figure 10 – In our study psoriasis was classified on the basis of severity using the PASI score:

- ✓ <10 – Mild psoriasis
- ✓ 10 – 20 – Moderate psoriasis
- ✓ 20.0 – Severe psoriasis

Out of 60 cases, the maximum number i.e. 22 cases (36.70%) had moderate psoriasis followed by severe psoriasis seen in 20 cases (33.30%). However, 18 cases (30.00%) had mild psoriasis. Also, the lowest PASI score was 1.5 while the highest PASI score was 56.3.

TABLE 11 : PASI SCORE OF CASES

PASI score	No. of cases (n)	Percentage (%)
< 10	18	30.00%
10-20	22	36.70%
> 20	20	33.30%

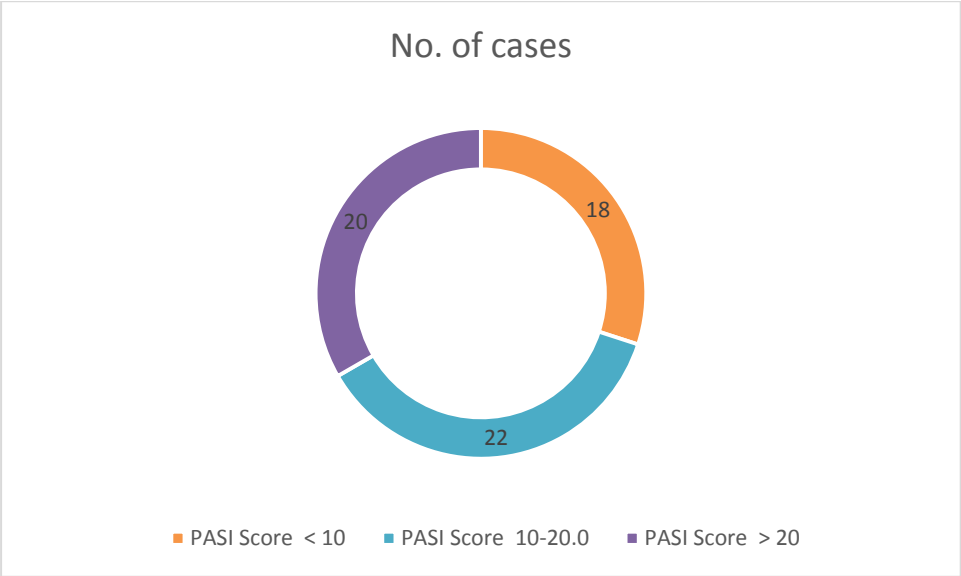

FIGURE 10 : PASI SCORE OF CASES

ASSOCIATION OF PASI SCORE WITH TYPES OF PSORIASIS

Table 12 and figure 11-

- In our study, the maximum number i.e. 22 out of 60 cases had moderate psoriasis. Out of these 22 cases, the maximum cases were of chronic plaque psoriasis (19) followed by palmoplantar psoriasis (2).
- Only one case with moderate psoriasis had flexural psoriasis.
- However, none of the patients with moderate psoriasis had erythrodermic, guttate, or generalized pustular psoriasis.
- Similarly, amongst cases with mild and severe psoriasis, chronic plaque psoriasis was the most common type.

TABLE 12 : ASSOCIATION OF PASI SCORE WITH TYPES OF PSORIASIS

PASI score	Type of psoriasis							Total
	CPP	EP	FP	GP	GPP	PP	SP	
< 10	7	0	0	1	0	7	3	18
10-20.0	19	0	1	0	0	2	0	22
> 20	17	1	0	0	2	0	0	20
Total	43	1	1	1	2	9	3	60

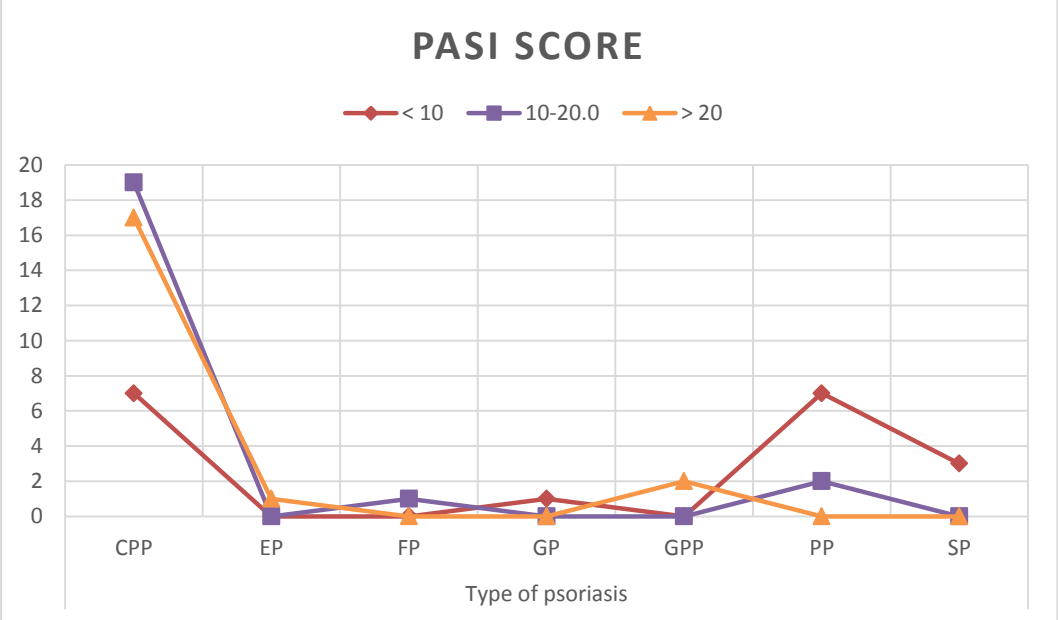

FIGURE 11 : ASSOCIATION OF PASI SCORE WITH TYPES OF PSORIASIS

ASSOCIATION OF COMORBIDITIES WITH PSORIASIS

Table 13 and figure 12- Nine (15.00%) out of 60 cases had associated diabetes mellitus whereas hypertension was present in 7 (11.70%) cases. However, both these associations were not statistically significant (p-value-0.396 & 0.396 respectively). Other less common comorbidities found in our cases were CAD (3.30%) and hypothyroidism (1.70%).

TABLE 13: ASSOCIATION OF COMORBIDITIES WITH PSORIASIS

Comorbidities	No. of cases (n)	Percentage (%)
Diabetes mellitus	9	15.00%
Hypertension	7	11.70%
CAD	2	3.30%
Hypothyroidism	1	1.70%

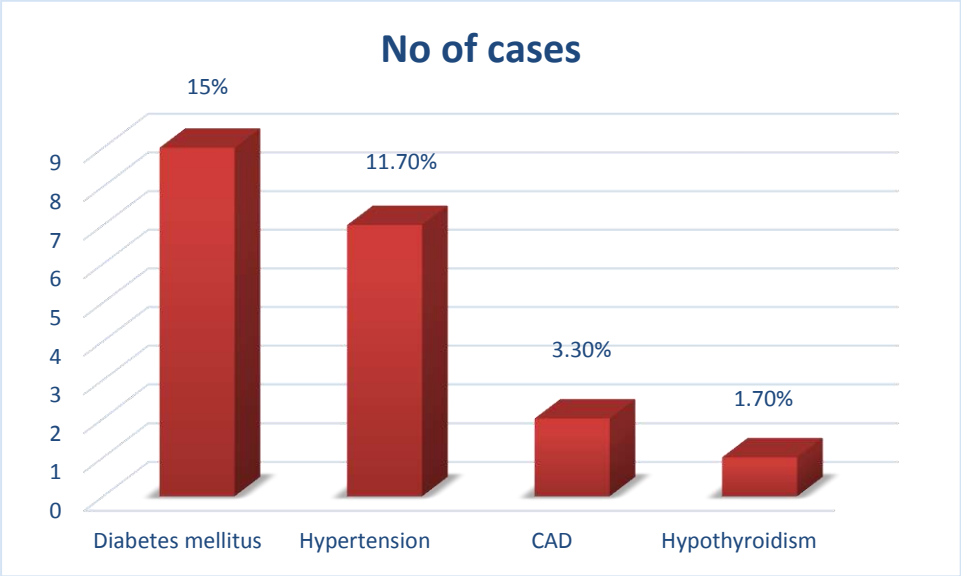

FIGURE 12: ASSOCIATION OF COMORBIDITIES WITH PSORIASIS

ASSOCIATION OF COMORBIDITIES WITH THE TYPES OF PSORIASIS

Table 14 and figure 13 –

- Chronic plaque psoriasis was associated with maximum comorbidities i.e. diabetes mellitus in 8 (18.6%) cases, hypertension in 6 (13.95%) cases and CAD in 2 cases (4.65%).
- Apart from chronic plaque psoriasis, generalized pustular psoriasis was associated with diabetes mellitus and hypertension with one case each.
- Hypothyroidism was the least common comorbidity only seen in one case with palmoplantar psoriasis.
- Erythrodermic, flexural and scalp psoriasis had no associated comorbidities.

TABLE 14 : ASSOCIATION OF COMORBIDITIES WITH THE TYPES OF PSORIASIS

Comorbidities	Types of psoriasis						
	CPP	EP	FP	GP	GPP	PP	SP
Diabetes mellitus	8	0	0	0	1	0	0
Hypertension	6	0	0	0	1	0	0
CAD	2	0	0	0	0	0	0
Hypothyroidism	0	0	0	0	0	1	0

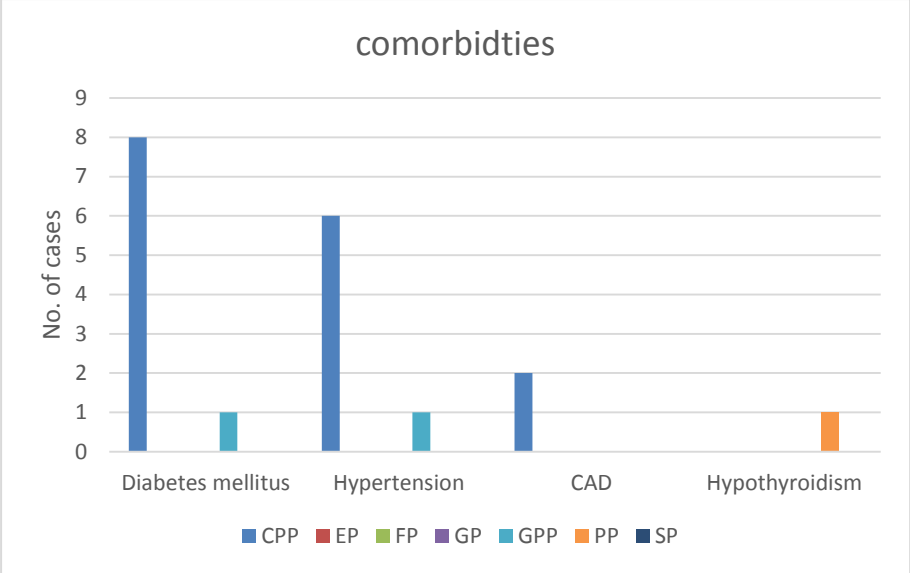

FIGURE 13 : ASSOCIATION OF COMORBIDITIES WITH THE TYPES OF PSORIASIS

ASSOCIATION OF COMORBIDTIES WITH THE PASI SCORE

Table 15 and figure 14-

- In our study, hypertension was associated with 7 cases of severe psoriasis which was statistically significant (p-value 0.001).
- Diabetes mellitus was found in 5.55%, 18.18%, 20.00% of the cases with mild, moderate and severe psoriasis respectively. Although, this association of diabetes mellitus with PASI score was not statistically significant (p-value 0.401).
- CAD was found in two cases with severe psoriasis (p-value 0.153) and hypothyroidism in one case with mild psoriasis. (p-value 0.289)

TABLE 15 : ASSOCIATION OF COMORBIDTIES WITH THE PASI SCORE

Comorbidties	**PASI SCORE**					
	<10		**10-20.0**		**>20**	
Diabetes mellitus	1	5.55%	4	18.18%	4	20.00%
Hypertension	0	0.00%	0	0.00%	7	35.00%
CAD	0	0.00%	0	0.00%	2	10.00%
Hypothyroidism	1	5.55%	0	0.00%	0	0.00%

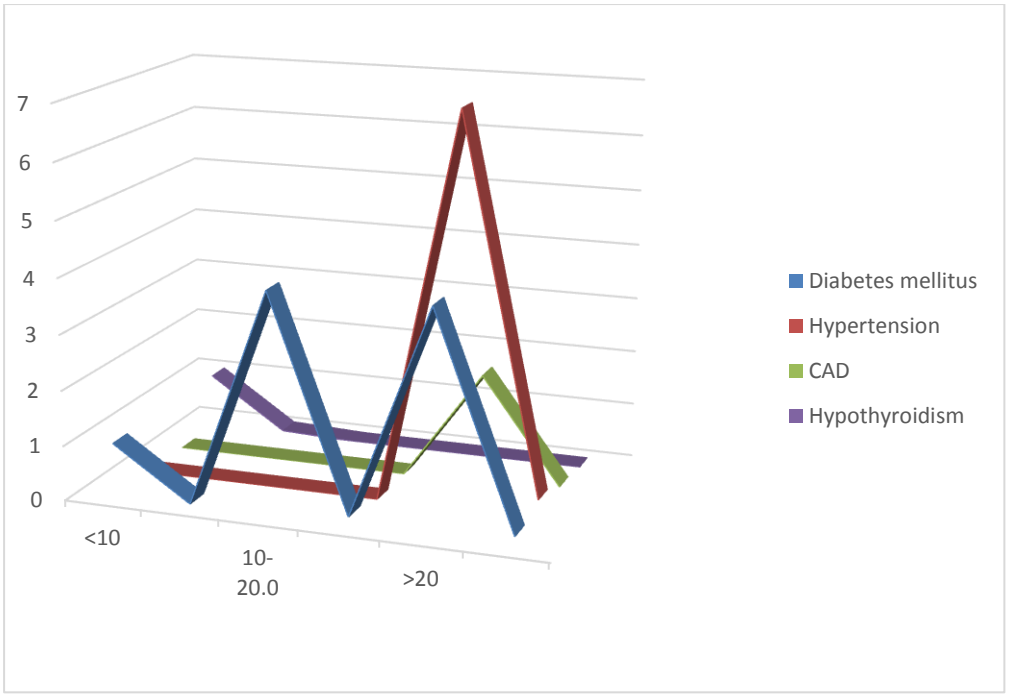

FIGURE 14 : ASSOCIATION OF COMORBIDTIES WITH THE PASI SCORE

ASSOCIATION OF NAIL CHANGES WITH THE PSORIASIS

Table 16 and figure 15- In our study, nail changes were present in 43.30% of the cases as compared to 13.30% of the controls. Therefore, nail changes showed a statistically significant association with the psoriasis (p-value-0.039).

TABLE 16 : ASSOCIATION OF NAIL CHANGES WITH THE PSORIASIS

		Cases		Controls		Total
		No. of cases	%age	No. of cases	%age	
Nail changes	N	34	56.70%	13	86.70%	47
	Y	26	43.30%	2	13.30%	28
Total		60	100.00%	15	100.00%	75

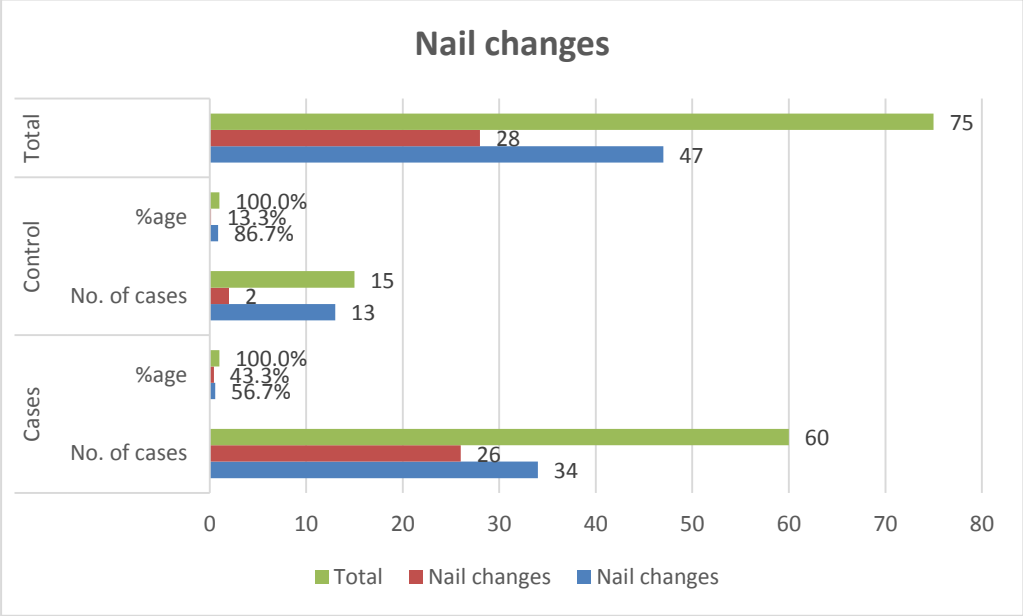

FIGURE 15 : ASSOCIATION OF NAIL CHANGES WITH THE PSORIASIS

TYPES OF NAIL CHANGES IN PSORIASIS

Table 17 and figure 16-

- Seven different types of nail changes were noted in 60 patients.
- More than one nail changes were present in the same individual in some of the cases.
- Nail pitting was the most common finding present in 22 cases (36.67%) followed by onycholysis (10.00%), and beau's lines (8.33%).
- The least common findings were salmon patch and splinter hemorrhages present in 3 cases each(5.00%).

TABLE 17 :TYPES OF NAIL CHANGES IN PSORIASIS

Nail changes	No. of cases (n)	Percentage (%)
Nail pitting	22	36.67%
Salmon patch	3	5.00%
Subungual hyperkeratosis	4	6.67%
Beau's lines	5	8.33%
Longitudinal ridges	4	6.67%
Splinter hemorrhages	3	5.00%
Onycholysis	6	10.00%

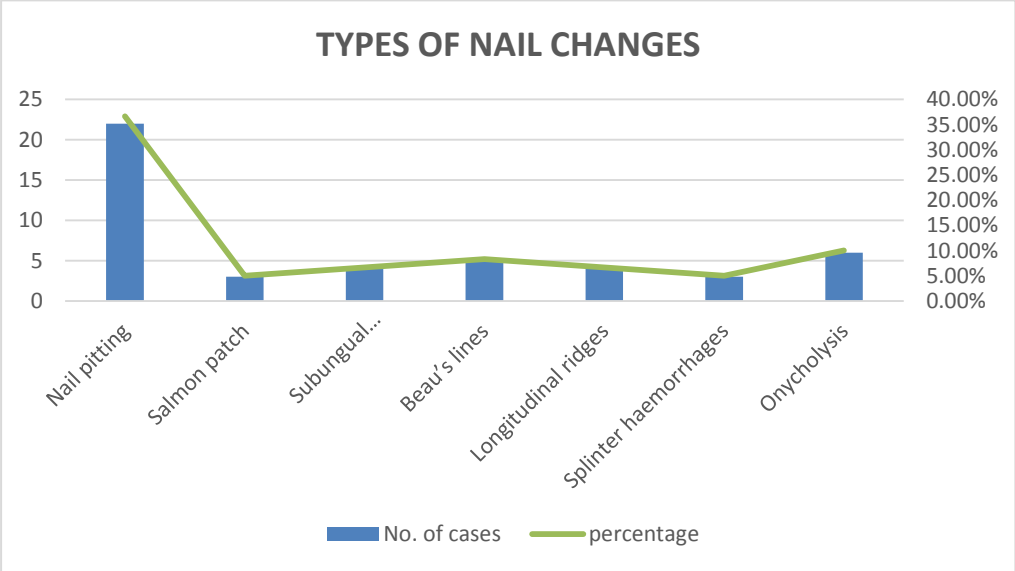

FIGURE 16 : TYPES OF NAIL CHANGES IN PSORIASIS

ASSOCIATION OF JOINT INVOLVEMENT WITH PSORIASIS

Table 18 and figure 17 – Joint involvement was seen in 11 (18.30%) cases in our study compared to none in controls. This finding however was not significant (p-value-0.107). Most of the cases with joint involvement reported asymmetrical oligoarthritis and symmetrical polyarthritis.

TABLE 18: ASSOCIATION OF JOINT INVOLVEMENT WITH PSORIASIS

		Cases		Control		Total
		No. of cases	%age	No. of cases	%age	
Joint involvement	N	49	81.70%	15	100.00%	64
	Y	11	18.30%	0	0.00%	11

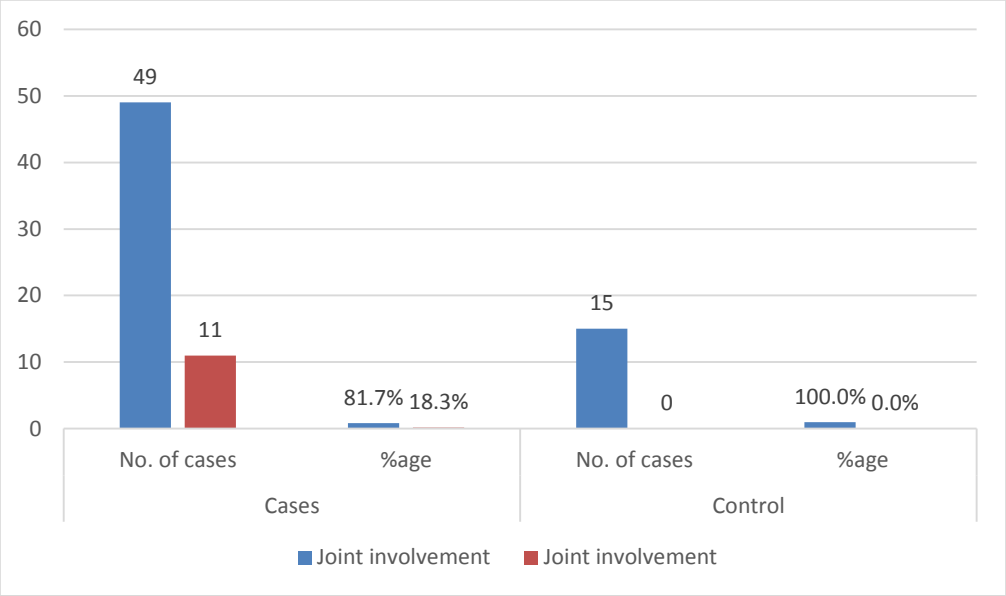

FIGURE 17 : ASSOCIATION OF JOINT INVOLVEMENT WITH PSORIASIS

ASSOCIATION OF JOINT INVOLVEMENT WITH THE PASI SCORE

Table 19 and figure 18-

- The joint involvement showed a significant association with the severity of psoriasis (p-value- 0.050).
- The joint involvement was seen in 1 (5.60%) of mild, 3 (13.60%) of moderate and 7 (35.00%) of the cases with severe psoriasis.
- Thus, cases of severe psoriasis i.e. PASI score > 20 showed maximum joint involvement.

TABLE 19: ASSOCIATION OF JOINT INVOLVEMENT WITH THE PASI SCORE

		PASI Score						Total
		< 10		10-20.0		> 20		
Joint involvement	N	17	94.40%	19	86.40%	13	65.00%	49
	Y	1	5.60%	3	13.60%	7	35.00%	11
Total		18	100.00%	22	100.00%	20	100.00%	60

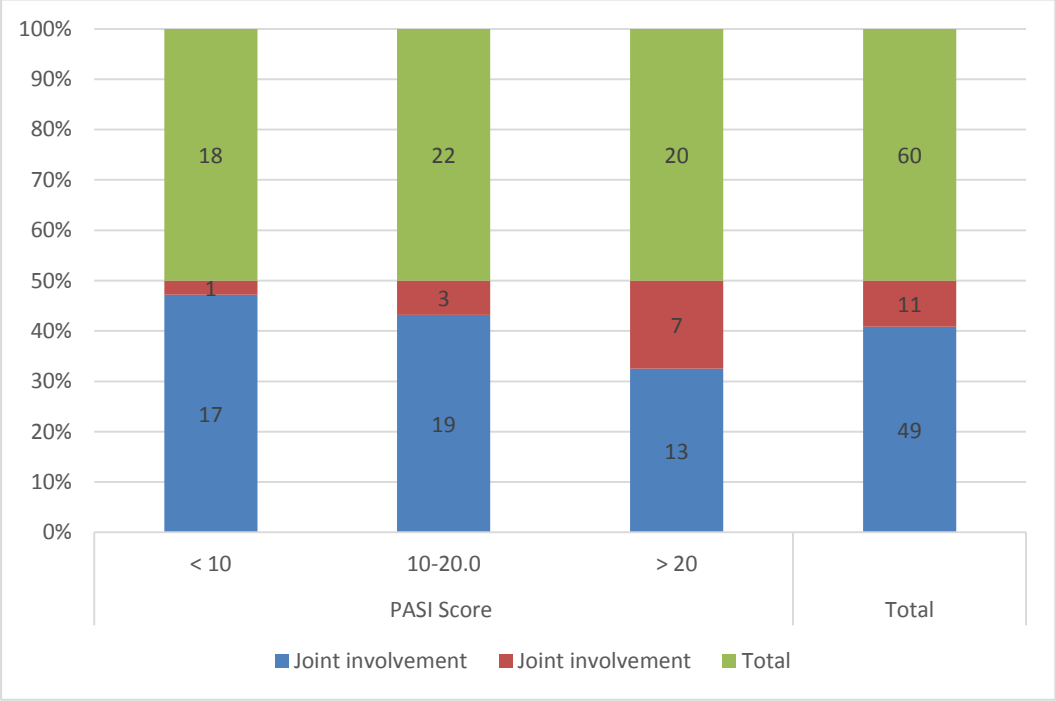

FIGURE 18 : ASSOCIATION OF JOINT INVOLVEMENT WITH THE PASI SCORE

DISTRIBUTION OF JOINT INVOLVEMENT AS PER TYPE OF PSORIASIS

Table 20 and figure 19-

- In our study, 8 out of 43 (18.60%) cases of chronic plaque psoriasis had associated joint involvement.
- One case each of erythrodermic, generalized pustular, and palmoplantar psoriasis had joint involvement.
- However, none of the joints were affected in cases with flexural, guttate, and scalp psoriasis.

TABLE 20 : DISTRIBUTION OF JOINT INVOLVEMENT AS PER TYPE OF PSORIASIS

Types of psoriasis	Joint involvement	Percentage (%)
CPP	8	18.60%
EP	1	100.00%
FP	0	0.00%
GP	0	0.00%
GPP	1	50.00%
PP	1	11.11%
SP	0	0.00%

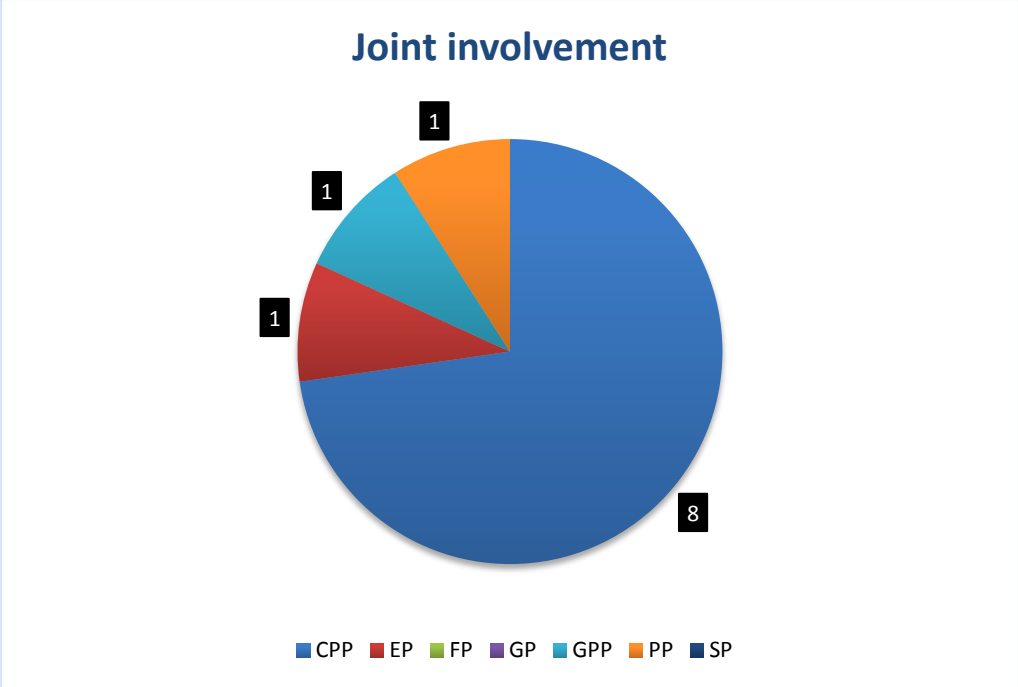

FIGURE 19 : DISTRIBUTION OF JOINT INVOLVEMENT AS PER TYPE OF PSORIASIS

ASSOCIATION OF SERUM URIC ACID LEVELS WITH PSORIASIS

Table 21 and figure 20 –

- SUA levels more than 6mg/dl in females and more than 7mg/dl in males is considered as hyperuricemia.
- 15 out of 60 (25.00%) cases in our study had hyperuricemia compared to 2 out of 15 (13.30%) controls. Thus, SUA levels were not significantly associated with psoriasis (p-value-0.334).
- The SUA levels amongst cases varied within a range of 3.4-10.6 mg/dl.

TABLE 21 : ASSOCIATION OF SERUM URIC ACID LEVELS WITH PSORIASIS

		Cases		**Control**		**Total**
		No. of cases (n)	**%age**	**No. of cases (n)**	**%age**	
SUA levels	Normal	45	75.0%	13	86.7%	58
	Hyperuricemia	15	25.0%	2	13.3%	17
Total		60	100.0%	15	100.0%	75

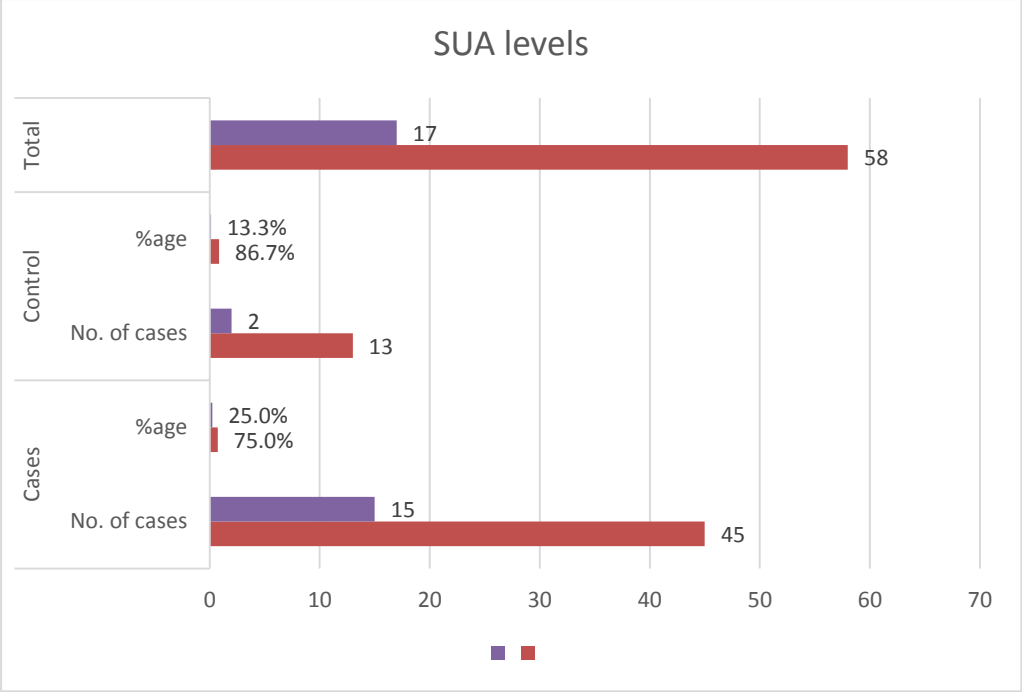

FIGURE 20 : ASSOCIATION OF SERUM URIC ACID LEVELS WITH PSORIASIS

GENDER-WISE DISTRIBUTION OF SERUM URIC ACID LEVELS

Table 22 and figure 21- In our study 12 out of 13 (26.70%) females and 33 out of 47 (73.30%) males had normal serum uric acid levels. Hyperuricemia was seen in 15 out of the total 60 cases including 1 (6.70%) female and 14 (93.30%) male cases. However, this gender-wise distribution of SUA levels did not show any significance (p-value-0.103)

TABLE 22 : GENDER-WISE DISTRIBUTION OF SERUM URIC ACID LEVELS

		SUA levels				Total
		Normal		Hyperuricemia		
Gender	F	12	26.70%	1	6.70%	13
	M	33	73.30%	14	93.30%	47

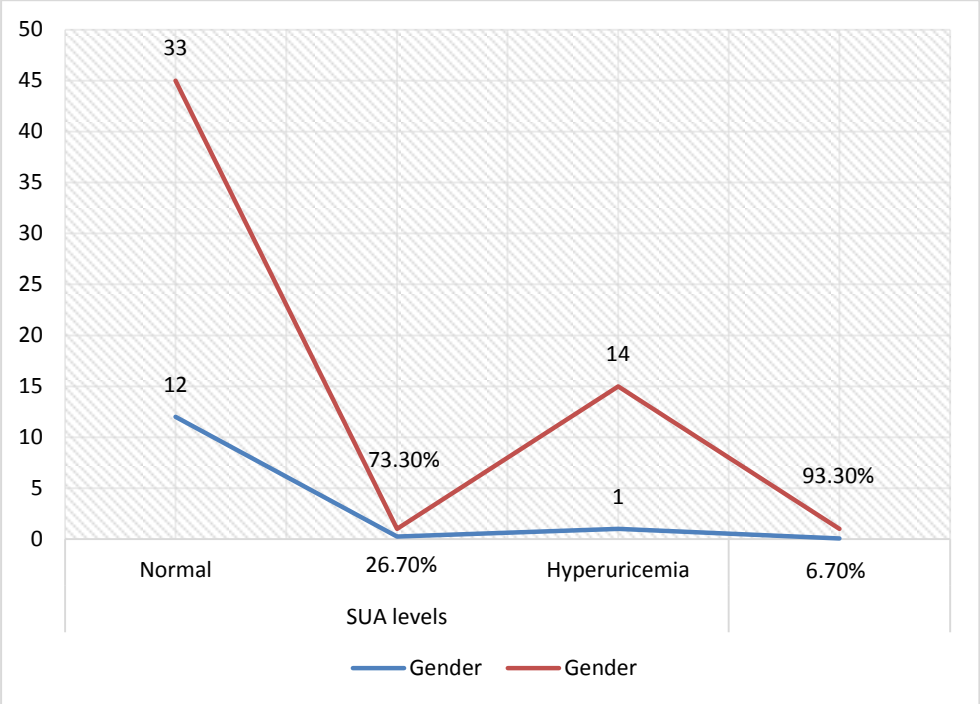

FIGURE 21 : GENDER-WISE DISTRIBUTION OF SERUM URIC ACID LEVELS

AGE-WISE DISTRIBUTION OF SERUM URIC ACID LEVELS IN PSORIASIS

Table 23 and figure 22- Hyperuricemia was seen in 15 out of 60 cases and out of these, the maximum cases belonged to the age group 31-40 years followed by 41-50 years. This was also in accordance with the age distribution of the cases, as maximum cases of psoriasis belonged to these age groups. Abnormalities in SUA levels were least in age < 30 & > 60 years.

TABLE 23 : AGE-WISE DISTRIBUTION OF SERUM URIC ACID LEVELS IN PSORIASIS

		SUA levels				Total
		Normal		Hyperuricemia		
Age group	< 30	5	11.10%	2	13.30%	7
	31-40	16	35.60%	4	26.70%	20
	41-50	12	26.70%	5	33.30%	17
	51-60	8	17.80%	3	20.00%	11
	> 60	4	8.90%	1	6.70%	5

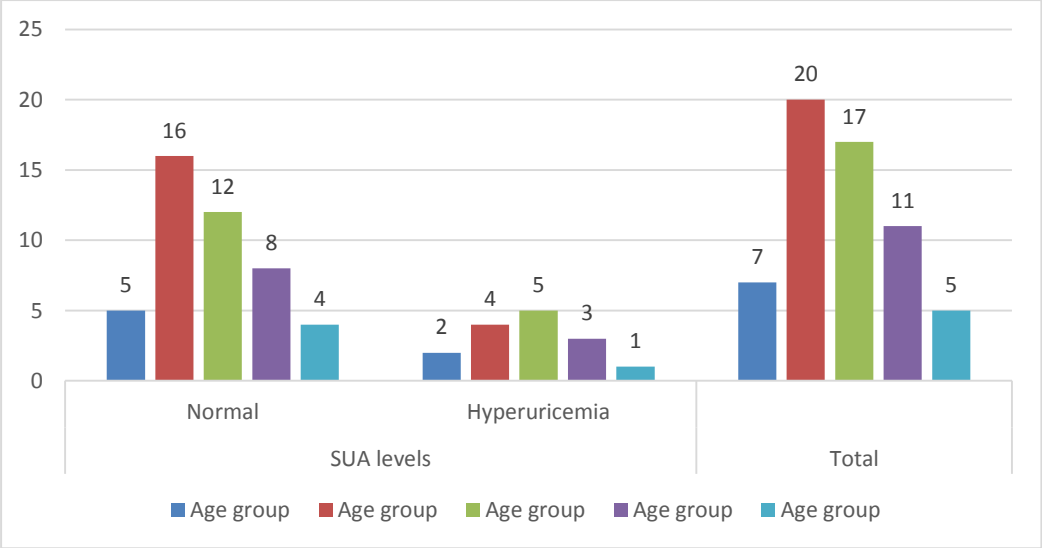

FIGURE 22 : AGE-WISE DISTRIBUTION OF SERUM URIC ACID LEVELS IN PSORIASIS

ASSOCIATION OF SERUM URIC ACID LEVELS WITH THE PASI SCORE

Table 24 and figure 23-

- Out of 15 cases with hyperuricemia, the largest fraction i.e. 9 (60.00%) cases had severe psoriasis (PASI > 20).
- The SUA levels were raised in 5 (33.30%) of cases with moderate and 1 (6.70%) cases with mild psoriasis.
- Therefore, the SUA levels showed a statistically significant association with the PASI score in our study (p-value-0.019).

TABLE 24 : ASSOCIATION OF SERUM URIC ACID LEVELS WITH THE PASI SCORE

		SUA levels				Total
		Normal		Hyperuricemia		
PASI Score	< 10.	17	37.80%	1	6.70%	18
	10-20.0	17	37.80%	5	33.30%	22
	> 20	11	24.40%	9	60.00%	20

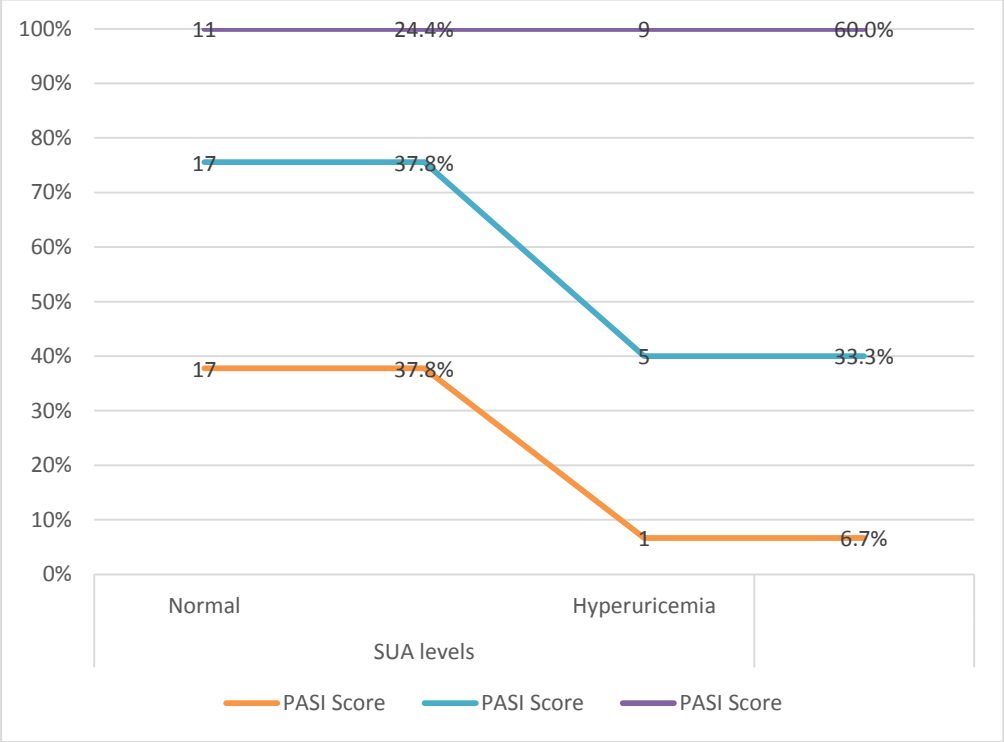

FIGURE 23 :ASSOCIATION OF SERUM URIC ACID LEVELS WITH THE PASI SCORE

DISTRIBUTION OF HYPERURICEMIA AMONG DIFFERENT TYPES OF PSORIASIS

Table 25 and figure 24- Hyperuricemia was most commonly found in cases of chronic plaque psoriasis i.e. 30.23% of the cases. One case each of generalized pustular psoriasis and palmoplantar psoriasis had associated hyperuricemia. However, the cases with erythrodermic, flexural, guttate or scalp psoriasis had SUA levels within the normal range for either sex.

TABLE 25 : DISTRIBUTION OF HYPERURICEMIA AMONG DIFFERENT TYPES OF PSORIASIS

Types of psoriasis	Hyperuricemia	Percentage (%)
CPP	13	30.23%
EP	0	0.00%
FP	0	0.00%
GP	0	0.00%
GPP	1	50.00%
PP	1	11.11%
SP	0	0.00%

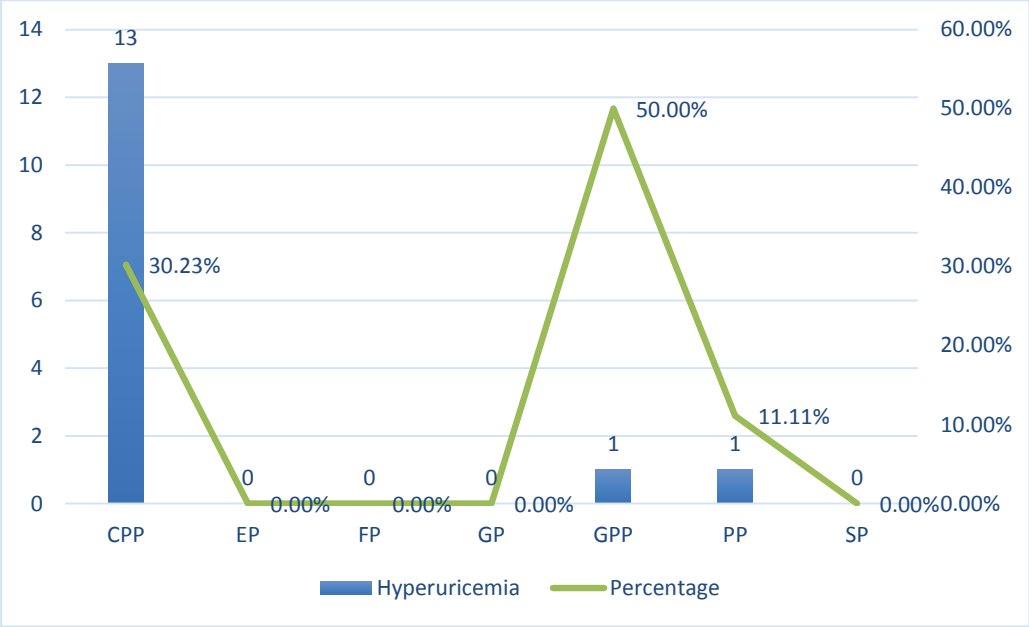

FIGURE 24 : DISTRIBUTION OF HYPERURICEMIA AMONG DIFFERENT TYPES OF PSORIASIS

ASSOCIATION OF SUA LEVELS WITH COMORBIDITIES IN PSORIASIS

Table 26 and figure 25-

- Out of 9 cases of psoriasis with diabetes mellitus, 2 (13.3%) cases had hyperuricemia (p-value-0.835).
- Out of 7 cases with hypertension, 4 (26.7%) cases had elevated SUA levels (p-value-0.058)
- The SUA levels were elevated in one case with CAD. None of the comorbidity showed significant association.

TABLE 26 : ASSOCIATION OF SUA LEVELS WITH COMORBIDITIES IN PSORIASIS

		SUA levels				Total
		Normal		Hyperuricemia		
Diabetes Mellitus	N	38	84.4%	13	86.7%	51
	Y	7	15.6%	2	13.3%	9
Hypertension	N	42	93.3%	11	73.3%	53
	Y	3	6.7%	4	26.7%	7
Others	CAD	1	2.2%	1	6.7%	2
	Hypothyroidism	1	2.2%	0	0.0%	1
	N	43	95.6%	14	93.3%	57

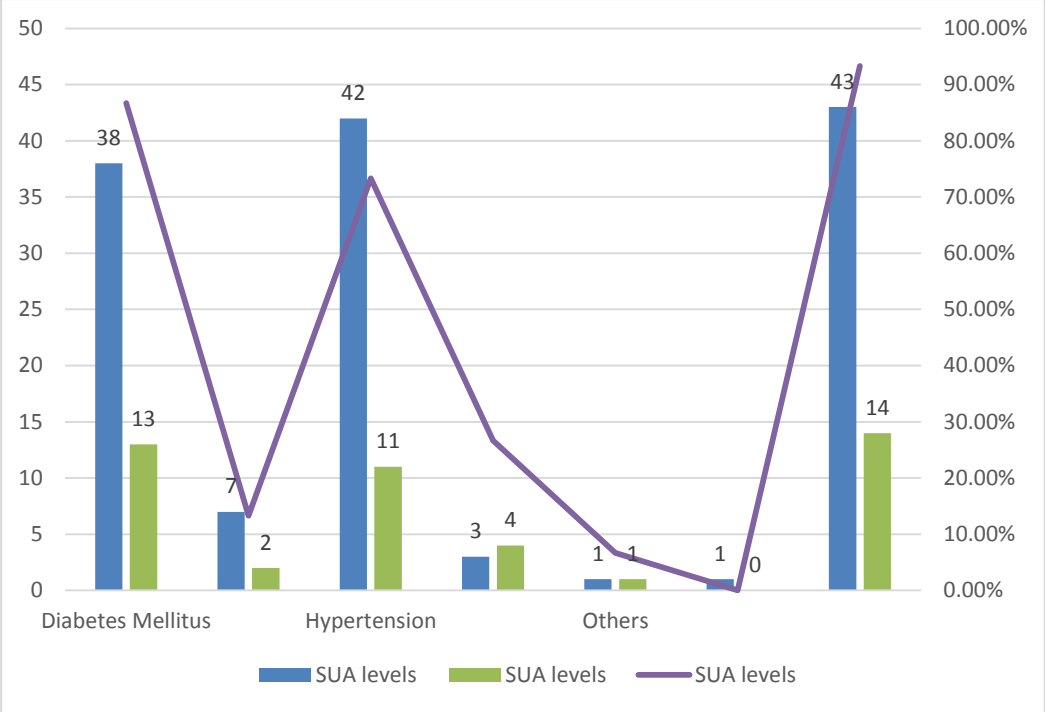

FIGURE 25 : ASSOCIATION OF SUA LEVELS WITH COMORBIDITIES IN PSORIASIS

ASSOCIATION OF NAIL CHANGES WITH SUA LEVELS IN PSORIASIS

Table 27 and figure 26- Out of 26 patients with nail changes, only 8 (53.30%) cases had hyperuricemia, rest 18 (40.00%) cases had normal SUA acid levels. No significant association between SUA levels and nail changes was found (p-value-0.367)

TABLE 27 : ASSOCIATION OF NAIL CHANGES WITH SUA LEVELS IN PSORIASIS

		SUA levels				Total
		Normal		Hyperuricemia		
Nail changes	N	27	60.00%	7	46.70%	34
	Y	18	40.00%	8	53.30%	26

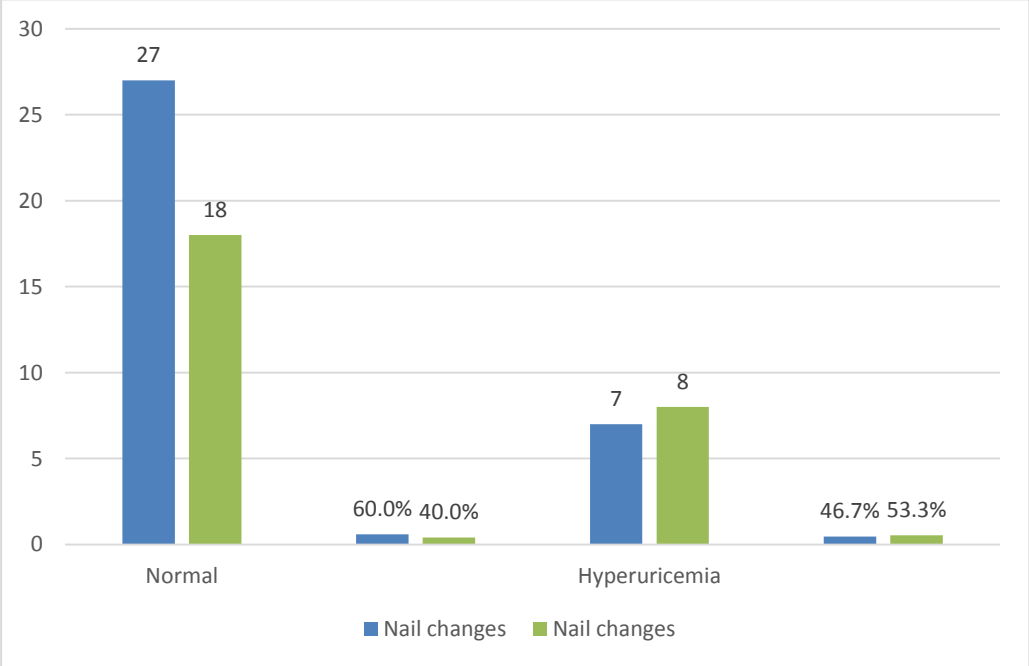

FIGURE 26 : ASSOCIATION OF NAIL CHANGES WITH SUA LEVELS IN PSORIASIS

ASSOCIATION OF SUA LEVELS WITH JOINT INVOLVEMENT IN PSORIASIS

Table 28 and figure 27- Out of 11 cases of psoriasis with joint involvement, only 5 (33.30%) cases had hyperuricemia. Remaining, 10 cases of psoriasis with hyperuricemia had no evidence of joint involvement. This made an association between SUA levels and joint involvement non significant (p-value-0.122)

TABLE 28 : ASSOCIATION OF SUA LEVELS WITH JOINT INVOLVEMENT IN PSORIASIS

		SUA levels				Total
		Normal		Hyperuricemia		
Joint involvement	N	39	86.70%	10	66.70%	49
	Y	6	13.30%	5	33.30%	11

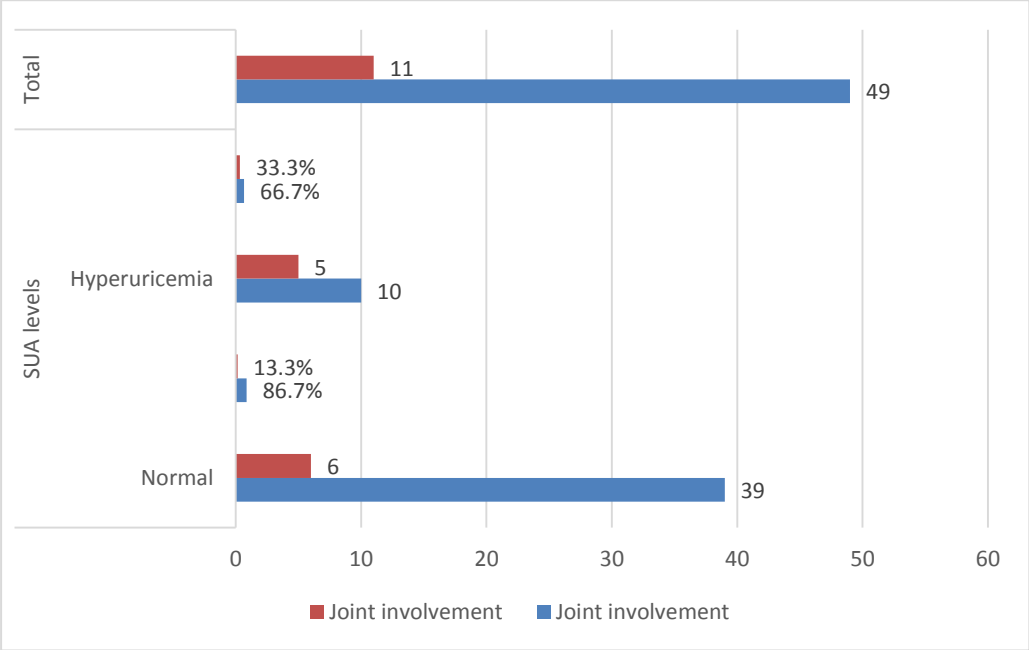

FIGURE 27 : ASSOCIATION OF SUA LEVELS WITH JOINT INVOLVEMENT IN PSORIASIS

DISCUSSION

Psoriasis is a common, chronic skin disease with multifactorial etiology and genetic susceptibility. Due to the exaggerated proliferation of keratinocytes, levels of Serum uric acid are frequently raised in patients with psoriasis. Increased nucleic acid turnover due to accelerated proliferation results in hyperuricemia in 30-40% of the patients.[217]

In this study, 60 cases of psoriasis and 15 BMI matched controls were taken over a period of one year. Levels of SUA were estimated and Serum uric acid of the patients was correlated to the severity of psoriasis.

AGE:

In our study, the mean age of cases and controls was 43.05±11.17 years and 46.93±11.23 years respectively which was comparable to the study conducted by Solak et al. [216] in which the mean age of cases and controls was 44.1±14.4 years and 44.1 ± 14.4 years respectively. Similarly, Das et al. [217] showed a mean age of 39.7 ± 7.3 years among the psoriasis group and 41.5±18.5 years among controls. However, the mean age by Agravatt et al.[3] was 40.6±11.8 years among cases and 39±6.48 years among controls.

TABLE 29 : COMPARISON OF MEAN AGE AMONG DIFFERENT STUDIES

Age (Mean±SD)	Sayami et al.[215] (2021)	Solak et al.[216] (2017)	Das et al.[217] (2013)	Agravatt et al.[3] (2013)	Present study
Cases	42±16.48 years	44.1±14.4 years	39.7±7.3 years	40.6±11.8 years	43.05±11.17 years
Controls	39.6±65 years	44.1±14.4 years	41.5±18.5 years	39±6.48 years	46.93±11.23 years

GENDER:

In our study, the male patients were predominant comprising 78.3% of study patients (n=47) and female patients were 21.7% (n=13). The male preponderance was also noted in studies conducted by Sayami et al.[215] and Takahashi et al.[218]. However, female predominance was noted in studies done by Kundakci et al.[219] and Agravatt et al.[3]

TABLE 30: COMPARISON OF GENDER DISTRIBUTION AMONG DIFFERENT STUDIES

Gender distribution of cases	Sayami et al.[215] (2021)	Takahashi et al.[218] (2009)	Kundakci et al.[219] (2002)	Agravatt et al.[3] (2013)	Present study
Females	19 (36.5%)	204 (33.6%)	201 (61%)	26 (52%)	13 (21.7%)
Males	33 (63.5%)	403 (66.4%)	128 (39%)	24 (48%)	47 (78.3%)

MEAN SERUM URIC ACID LEVELS:

In our study, the mean SUA in cases and controls was 5.88±1.67 mg/dl and 5.27±1.19 mg/dl respectively. Also, the mean SUA levels in cases were 4.59±0.91 mg/dl in females, 6.24±1.66 mg/dl in males whereas 4.71±1.22 mg/dl in females and 5.90± 0.83 mg/dl in males respectively in the control group. In a similar study done by Gisondi et al.[222], the mean SUA in psoriasis cases was 5.61±1.6 mg/dl and in controls was 4.87±1.4 mg/dl.

TABLE 31: COMPARISON OF MEAN SERUM URIC ACID LEVELS AMONG DIFFERENT STUDIES

SUA levels (mean)	Kwon HH et al.[220] (2011)	Gisondi et al.[222] (2014)	Das et al.[217] (2013)	Zhang et al.[221] (2012)	Present study
Cases	5.1 ±1.5 mg/dl	5.61±1.6 mg/dl	8.05±2.01 mg/dl	6.56±1.22 mg/dl	5.88±1.67 mg/dl
Controls	5.15 ±1.4 mg/dl	4.87±1.4 mg/dl	4.1±1.5 mg/dl	3.44±1.16 mg/dl	5.27±1.19 mg/dl

HYPERURICEMIA:

In our study, the prevalence of hyperuricemia among cases was found to be 25% compared to 13.3% among cases with a p-value of 0.334 which was statistically insignificant. Similar results were shown by Cassano et al.[224] where the prevalence of hyperuricemia in cases and controls was 10% and 6% respectively. However, the prevalence of hyperuricemia was 40.7% in a study by Ukonu et al.[223] with a p-value of 0.001. Studies by Sayami et al.[215] and Gisondi et al.[222] also showed a significant association between psoriasis and serum uric acid with p-value of 0.012 and < 0.001 respectively.

TABLE 32: COMPARISON OF PREVALENCE OF HYPERURICEMIA SEEN IN DIFFERENT STUDIES

Prevalence of hyperuricemia	Ukonu et al.[223] (2016)	Sayami et al.[215] (2021)	Gisondi et al.[222] (2014)	Cassano et al.[224] (2011)	Present study
Cases	40.7%	17.3%	19.0%	10.0%	25%
Controls	7.0%	3.0%	7.0%	6.0%	13.3%

PASI SCORE AND SUA LEVELS:

In our study, the mean SUA of the cases based on PASI Score with <10, 10-20 and >20 were found to be 5.11±1.49 mg/dl, 5.96±1.58 mg/dl and 6.49±1.71 mg/dl respectively. Thus, the mean SUA was in increasing order as the severity of psoriasis increased. Similarly, in a study done by Sayami et al.[215] mean SUA based on PASI score was 4.77±0.85 mg/dl, 5.33±1.36 mg/dl and 5.82±1.97 mg/ dl respectively.

In our study, 60% (n=9) of the cases with elevated SUA levels had PASI score > 20. Out of the remaining 40% of cases, 33.3% (n=5) had PASI score between 10-20, and 6.7%(n=1) had a PASI <10. Also, our study showed a statistically significant increase in SUA levels with the PASI score with a p-value of 0.019. Likewise, Sayami et al.[215] observed a statistically significant increase in SUA level with PASI

Score (p-value= 0.021). Gisondi et al.[222] also noticed higher SUA levels in psoriatic patients with PASI score ≥10 (p-value < 0.01). Our findings were in accordance with the study by Kwon HH et al.[220] where he reported no significant difference between SUA levels of psoriatic patients and healthy controls but found a positive correlation between SUA levels and PASI score. However, studies by Agravatt et al.[3] and Cassano et al.[224] revealed no significant correlation between serum uric acid level and PASI score with value of ≥ 0.05 and 0.34 respectively.

SUMMARY AND CONCLUSION

The present study was conducted to study the serum uric acid levels in patients with psoriasis and to correlate the levels with the severity of the disease. A total of 60 cases and 15 BMI matched controls were evaluated during the study period of one year. Serum uric acid levels were calculated and the SUA of the patients was correlated to PASI score, type of psoriasis and was compared with SUA levels of BMI matched controls.

The observations and results were tabulated and represented graphically. The summary of observations is as follows:

- Majority of the cases were in age group 31-50 years (56.67%) and controls in age group of 41-50 years (46.67%).
- Mean age of cases and controls was 43.05±11.17 years and 46.93±11.23 years respectively.
- Male preponderance was seen in cases (78.3%) compared to female preponderance in controls (53.3%).
- Maximum cases had chronic plaque psoriasis (71.7%) followed by palmoplantar psoriasis(15%).
- Maximum number of cases had moderate psoriasis (36.7%) with the highest PASI score was 56.3 followed by severe psoriasis (33.3%) & mild psoriasis (30.0%)
- Nail changes were present in 43.3% of the cases and nail pitting was the commonest (36.67%).
- Nail changes were significantly associated with psoriasis with a p-value of 0.039.
- Joint involvement seen in 18.3% of cases showed no significant association. (p-value-0.107).
- Hyperuricemia was seen in 25% of cases compared to 13.3% of controls. Thus, SUA levels were not significantly associated with psoriasis (p-value-0.334).
- Mean SUA of cases was 5.88±1.67 mg/dl whereas the mean SUA of controls was 5.27±1.19 mg/dl. (p-value 0.187).
- Hyperuricemia was predominantly seen in male cases (93.3%).

- Majority of the cases with hyperuricemia had chronic plaque psoriasis (30.23%).
- Hyperuricemia was seen in 60.0% of cases with PASI > 20 compared to 33.3% of cases with PASI 10-20 & 6.7% of the cases with PASI <10.
- SUA levels showed a statistically significant association with the PASI score (p-value-0.019).
- SUA levels showed no significant association with nail changes and joint involvement. (p-value-0.367 and 0.122 respectively).

CONCLUSION

Psoriasis is a chronic inflammatory disorder extending involvement beyond the skin. Our study concludes that serum uric acid levels increase with the increase in severity of psoriasis which suggests an association between SUA levels and PASI score. Although SUA levels did not show significant relation with psoriasis when compared with healthy controls. The main limitations of our study were a limited time frame, relatively small sample size, and lack of follow-up.

As hyperuricemia showed a close relationship with PASI scores, serum uric acid levels of the psoriatic patients should be monitored during treatment as well as on follow-up visits. Our study lacked sufficient evidence to prove psoriasis as an independent risk factor for hyperuricemia as metabolic syndrome associated with psoriasis can also lead to elevated SUA levels. Therefore, SUA screening should be done with increased frequency in obese patients as elevated levels of SUA play a crucial role in the progression of metabolic syndrome, cardiovascular disorders, and gout in these patients.

Since psoriasis has a great psychosocial impact on the lives of these patients. The presence of comorbidities can further have a deleterious impact on quality of life. Thus, appropriate screening of SUA levels and management of hyperuricemia can prevent this. A multi-disciplinary approach involving physicians and dermatologists might be helpful in the global treatment of patients.

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Picture 1a: Chronic plaque psoriasis involving extensors

Picture 1b: Well-demarcated plaques with silvery white scales

Picture 1c: Large well-demarcated red scaly plaques

Picture 1d: Full rich red colour of plaques

Picture 2a:Scalp psoriasis

Picture 2b: Scalp psoriasis extending beyond hairline.

Picture 3 : Involvement of ears in psoriasis

Picture 4: Guttate psoriasis

Picture 5a: Palmoplantar psoriasis

Picture 5b : Palmoplantar psoriasis with nail changes

Picture 6a: Inframammary flexural psoriasis

Picture 6b: Flexural psoriasis involving axilla

Picture 7a: Erythrodermic psoriasis

Picture 7b: Erythrodermic psoriasis

Picture 8a: Nail psoriasis

Picture 8b: Nail psoriasis

Picture 9: Grattage test

Picture 10: Auspitz sign

PROFORMA

S.NO :

Name : Date:

MRD No. :

Age: Sex:

Father/Husband's name:

Occupation:

Marital Status:

Address:

Contact No:

Diagnosis:

Chief complaint:

History of any Associated illness:

Signature of Candidate **Signature of Supervisor**

General Physical examination:

Height(m) Weight(kg) BMI(kg/m^2)

Morphology of Lesions:

Type of psoriasis:

Duration of disease:

PASI Score:

Nail changes:

Joint involvement:

Investigations

Serum Uric Acid:

Signature of Candidate **Signature of Supervisor**

KEY TO MASTER CHART

CAD	Coronary artery disease
CPP	Chronic plaque psoriasis
EP	Erythrodermic psoriasis
F	Female
FP	Flexural psoriasis
GP	Guttate psoriasis
GPP	Generalized pustular psoriasis
M	Male
N	No
PP	Palmoplantar psoriasis
SP	Scalp psoriasis
Y	Yes

S. No	Date	Name	MRD No.	Age(years)	Sex	Marital status	Chief complaints				Duration of disease(months)
							Redness	Scaling	Pain	Itching	
1	03-03-2021	BS	207975	54	M	Married	Y	Y	N	Y	11
2	10-03-2021	GA	1047170	55	M	Married	Y	Y	N	Y	32
3	22-04-2021	RS	1095133	51	M	Married	Y	Y	N	Y	30
4	13-05-2021	AS	1034357	17	M	Unmarried	Y	Y	N	Y	12
5	18-05-2021	AK	66851	36	M	Married	Y	Y	N	N	4
6	26-05-2021	SD	194733	48	F	Married	Y	Y	N	N	8
7	03-06-2021	SK	1117013	40	F	Married	Y	Y	Y	N	48
8	21-06-2021	SG	1073825	23	M	Unmarried	Y	Y	N	N	120
9	22-06-2021	SS	1125966	29	M	Unmarried	Y	Y	N	Y	48
10	30-06-2021	K	694655	47	F	Married	Y	Y	N	Y	96
11	01-07-2021	KK	6569	39	F	Married	Y	Y	N	Y	6
12	06-07-2021	AR	256180	66	M	Married	Y	Y	N	Y	264
13	16-07-2021	KK	405140	30	F	Unmarried	Y	Y	N	N	84
14	22-07-2021	PS	1140756	34	F	Married	Y	Y	N	N	168
15	23-07-2021	A	1258723	30	M	Unmarried	Y	Y	N	Y	36
16	24-07-2021	DL	1141963	60	M	Married	Y	Y	N	N	24
17	24-07-2021	SK	1088102	57	F	Married	N	N	N	Y	144
18	27-07-2021	SS	220456	52	M	Married	Y	Y	Y	N	24
19	31-07-2021	M	1087365	28	F	Married	Y	Y	Y	N	54
20	04-08-2021	RS	1145237	40	M	Married	Y	Y	N	N	3
21	06-08-2021	R	160449	42	F	Married	Y	Y	N	N	18
22	07-08-2021	RD	1264957	64	F	Married	Y	Y	N	N	12
23	08-08-2021	HK	1133781	32	M	Married	Y	Y	N	Y	72
24	04-09-2021	V	1145852	37	M	Married	Y	Y	N	N	72
25	13-09-2021	IA	1202125	48	M	Married	Y	Y	N	N	144
26	23-09-2021	SC	1178578	62	M	Married	Y	Y	N	Y	120
27	05-10-2021	AS	136048	44	M	Married	Y	Y	N	N	48
28	21-10-2021	NB	1257600	50	M	Married	Y	Y	N	N	420
29	26-10-2021	BB	1197487	29	M	Unmarried	Y	Y	Y	N	12
30	09-11-2021	AS	1015564	41	M	Married	Y	Y	N	N	48
31	16-11-2021	GS	1208665	49	M	Married	Y	Y	N	N	96
32	18-11-2021	HS	1209798	49	M	Married	Y	Y	N	Y	36
33	18-11-2021	LS	588007	27	M	Unmarried	Y	Y	N	Y	24
34	26-11-2021	RK	1213930	62	F	Married	Y	N	Y	N	360
35	02-12-2021	GV	726295	62	M	Married	N	Y	Y	N	84
36	12-12-2021	NK	1302781	39	M	Married	Y	Y	N	P	60
37	14-12-2021	HS	1223922	40	M	Married	Y	Y	Y	N	144
38	14-12-2021	NS	1223924	39	M	Married	Y	Y	N	N	72
39	17-12-2021	HL	1255237	46	M	Married	Y	Y	Y	N	48
40	22-12-2021	RS	1291762	37	M	Married	Y	Y	Y	N	6
41	29-12-2021	KS	1276696	47	M	Married	Y	Y	N	N	48
42	03-01-2022	J	1259931	55	F	Married	Y	Y	N	N	12
43	08-01-2022	BS	705190	30	M	Unmarried	Y	Y	N	N	48
44	08-01-2022	LS	1235990	50	M	Married	Y	Y	N	N	12
45	11-01-2022	R	1237440	34	M	Married	Y	Y	N	Y	6
46	12-01-2022	MS	1270653	26	M	Unmarried	Y	Y	N	Y	36
47	24-01-2022	KS	1275290	33	M	Married	Y	Y	Y	Y	36
48	25-01-2022	G	1276043	32	M	Married	Y	Y	N	N	36
49	31-01-2022	MS	1246807	51	M	Married	Y	Y	N	N	300
50	01-02-2022	DK	1240759	37	M	Married	N	Y	Y	N	60
51	05-02-2022	HS	1247387	52	M	Married	Y	Y	N	Y	60
52	07-02-2022	OP	1133285	49	M	Married	N	Y	Y	N	6
53	10-02-2022	RS	1251790	52	M	Married	Y	Y	N	Y	96
54	15-02-2022	RK	1254092	41	M	Married	Y	Y	N	N	12
55	19-02-2022	BS	1256385	42	M	Married	Y	Y	N	N	108
56	21-02-2022	HK	1273403	45	F	Married	Y	Y	N	Y	30
57	23-02-2022	PK	1185545	32	M	Unmarried	Y	Y	N	N	12
58	23-02-2022	BS	1258386	39	M	Married	Y	Y	Y	Y	18
59	26-02-2022	MK	1276794	50	M	Married	Y	Y	N	N	40
60	28-02-2022	PK	195832	51	M	Married	Y	N	Y	N	18

S. No	History of any associated illness			Diagnosis	General Physical examination			Morp	
	Diabetes Mellitus	Hypertension	Others		Height(m)	Weight(kg)	BMI(kg/m2)	Erythematous plaques	Scaling
1	N	N	N	Psoriasis	1.07	84	26.6	Y	Y
2	N	N	N	Psoriasis	1.78	78	24.7	Y	Y
3	N	Y	N	Psoriasis	1.52	82	26.7	Y	Y
4	N	N	N	Psoriasis	1.82	76	22.1	Y	Y
5	N	N	N	Psoriasis	1.78	68	23.5	Y	Y
6	N	N	N	Psoriasis	1.61	58	22.7	Y	Y
7	N	Y	N	Psoriasis	1.52	76	29.7	Y	Y
8	N	N	N	Psoriasis	1.7	55	19.6	Y	Y
9	N	N	N	Psoriasis	1.83	100	29.9	Y	Y
10	N	N	Hypothyroidism	Psoriasis	1.52	80	34.4	Y	Y
11	N	N	N	Psoriasis	1.64	80	30.2	Y	Y
12	N	N	N	Psoriasis	1.67	47	16.9	Y	Y
13	N	N	N	Psoriasis	1.64	107	39.5	Y	Y
14	N	N	N	Psoriasis	1.5	64	26.6	Y	Y
15	N	N	N	Psoriasis	1.79	89	29	Y	Y
16	Y	N	N	Psoriasis	1.7	67	23	Y	Y
17	N	N	N	Psoriasis	1.7	69	23.9	N	N
18	N	N	N	Psoriasis	1.67	70	24.9	Y	Y
19	N	Y	N	Psoriasis	1.58	93	37	Y	Y
20	N	N	N	Psoriasis	1.7	80	27.5	Y	Y
21	N	N	N	Psoriasis	1.58	58	23.1	Y	Y
22	Y	N	N	Psoriasis	1.55	72	30	Y	Y
23	N	N	N	Psoriasis	1.8	101.5	33	Y	Y
24	N	N	N	Psoriasis	1.7	75	24.8	Y	Y
25	N	N	CAD	Psoriasis	1.73	78	26.9	Y	Y
26	N	N	N	Psoriasis	1.75	88	28.7	Y	Y
27	N	N	N	Psoriasis	1.76	58	18.6	Y	Y
28	N	N	N	Psoriasis	1.7	74	26.3	Y	Y
29	N	N	N	Psoriasis	1.64	50	18.5	Y	Y
30	N	N	N	Psoriasis	1.8	92	28.4	Y	Y
31	Y	N	N	Psoriasis	1.7	104	36	Y	Y
32	N	N	N	Psoriasis	1.7	98	33.6	Y	Y
33	N	N	N	Psoriasis	1.79	68	21	Y	Y
34	Y	Y	N	Psoriasis	1.46	48	23.7	Y	N
35	N	N	N	Psoriasis	1.55	56	23.3	N	Y
36	Y	Y	N	Psoriasis	1.73	85	29.3	Y	Y
37	N	N	N	Psoriasis	1.67	79	29	Y	Y
38	N	N	N	Psoriasis	1.92	105	28.9	Y	Y
39	N	N	N	Psoriasis	1.7	66	23.4	Y	Y
40	N	N	N	Psoriasis	1.73	75	25.9	Y	Y
41	N	N	N	Psoriasis	1.7	67	23	Y	Y
42	N	N	N	Psoriasis	1.5	58	24.2	Y	Y
43	N	N	N	Psoriasis	1.76	68	22.7	Y	Y
44	Y	N	N	Psoriasis	1.7	70	24.9	Y	Y
45	N	N	N	Psoriasis	1.61	60	23.4	Y	Y
46	N	N	N	Psoriasis	1.79	58	18.9	Y	Y
47	N	N	N	Psoriasis	1.8	95	29.2	Y	Y
48	N	N	N	Psoriasis	1.76	55	18.4	Y	Y
49	Y	Y	N	Psoriasis	1.8	104	32.9	Y	Y
50	N	N	N	Psoriasis	1.67	93	34.1	N	Y
51	Y	N	N	Psoriasis	1.8	77	24.4	Y	Y
52	N	N	N	Psoriasis	1.78	68	23.5	N	Y
53	Y	N	CAD	Psoriasis	1.7	65	23.1	Y	Y
54	N	N	N	Psoriasis	1.64	64	24.2	Y	Y
55	N	Y	N	Psoriasis	1.73	64	22.1	Y	Y
56	N	N	N	Psoriasis	1.6	54	21.1	Y	Y
57	N	N	N	Psoriasis	1.7	68	23.5	Y	Y
58	N	N	N	Psoriasis	1.67	80	29.3	Y	Y
59	N	N	N	Psoriasis	1.79	83	27	Y	Y
60	N	N	N	Psoriasis	1.67	92	33.8	Y	N

S. No	hology of lesions			Sites					Type of psoriasis	PASI Score	Nail changes	Pitting
	Induration	Pustules	Maceration	Scalp	Upper limb	Trunk	Lower limb	Palms & Soles				
1	Y	N	N	N	Y	N	Y	N	CPP	16.4	Y	Y
2	Y	N	N	Y	Y	Y	Y	N	CPP	20.5	Y	Y
3	Y	N	N	Y	Y	Y	Y	N	CPP	24.8	Y	Y
4	Y	N	N	N	Y	Y	Y	N	CPP	16.2	N	N
5	Y	N	N	N	N	N	N	Y	PP	6.4	N	N
6	Y	N	N	Y	Y	N	N	N	CPP	6.2	N	N
7	Y	N	N	Y	Y	Y	Y	N	CPP	26.2	Y	Y
8	N	N	N	Y	N	N	N	N	SP	1.5	N	N
9	N	N	N	Y	Y	Y	Y	N	CPP	16	N	N
10	Y	N	N	N	N	N	N	Y	PP	5.2	N	N
11	Y	N	N	N	N	N	N	Y	PP	4.4	Y	Y
12	Y	N	N	Y	Y	Y	Y	N	CPP	35	Y	Y
13	Y	N	Y	Y	Y	Y	Y	N	CPP	11.4	Y	Y
14	Y	N	N	N	Y	Y	Y	N	CPP	16.2	N	N
15	N	N	N	Y	N	N	N	N	SP	2.4	N	N
16	Y	N	N	Y	Y	N	Y	N	CPP	11.2	N	N
17	Y	N	N	N	N	N	N	Y	PP	2.8	N	N
18	Y	N	N	N	N	N	N	Y	PP	4.8	N	N
19	N	N	N	Y	Y	Y	Y	N	CPP	36.2	Y	Y
20	Y	N	N	Y	Y	N	Y	N	CPP	14	N	N
21	Y	N	N	N	Y	N	Y	N	CPP	12.6	N	N
22	N	N	N	N	N	Y	N	N	CPP	11.2	N	N
23	Y	N	N	Y	N	Y	N	N	CPP	8.8	Y	Y
24	Y	N	N	Y	Y	Y	Y	N	CPP	17.5	N	N
25	Y	N	N	Y	Y	Y	Y	N	CPP	12.6	Y	Y
26	Y	N	N	Y	Y	Y	Y	N	CPP	18.6	N	N
27	N	N	N	Y	Y	Y	Y	Y	EP	56.3	Y	Y
28	N	N	N	Y	Y	Y	Y	N	CPP	9.3	N	N
29	Y	N	N	Y	Y	Y	Y	N	CPP	25.8	Y	N
30	Y	N	N	Y	Y	Y	Y	Y	CPP	31.2	N	N
31	Y	N	N	Y	Y	Y	Y	N	CPP	24.3	Y	N
32	Y	N	N	N	Y	N	Y	N	CPP	32.4	N	N
33	Y	N	N	Y	Y	Y	Y	N	CPP	15.8	N	N
34	N	Y	N	N	Y	Y	Y	Y	GPP	27.6	Y	Y
35	Y	N	N	N	Y	N	N	Y	PP	12	N	N
36	Y	N	N	Y	Y	Y	Y	N	CPP	28.2	N	N
37	Y	N	N	Y	Y	Y	Y	Y	CPP	45.2	Y	Y
38	Y	N	N	Y	N	N	Y	N	CPP	11.9	Y	N
39	Y	N	N	Y	Y	Y	Y	N	CPP	19.3	Y	Y
40	Y	N	N	Y	Y	N	Y	N	CPP	22.4	N	N
41	Y	N	N	Y	Y	N	Y	N	GPP	38.2	Y	Y
42	N	N	N	N	Y	Y	Y	N	CPP	7.7	N	N
43	N	N	N	Y	Y	N	N	N	GP	3.3	N	N
44	N	N	N	Y	N	Y	N	N	CPP	6.2	Y	Y
45	Y	N	N	N	N	Y	Y	N	CPP	24.3	N	N
46	Y	N	N	Y	Y	Y	Y	Y	CPP	34.8	Y	Y
47	Y	Y	N	Y	Y	Y	Y	N	CPP	22.6	N	N
48	N	N	N	Y	N	N	N	N	SP	3.2	N	N
49	Y	N	N	Y	N	Y	Y	N	CPP	23.6	Y	Y
50	Y	N	N	N	N	N	N	Y	PP	4.8	Y	N
51	Y	N	N	Y	N	Y	Y	N	CPP	12	N	N
52	Y	N	N	N	N	N	N	Y	PP	12.2	N	N
53	Y	N	N	Y	Y	Y	N	N	CPP	18.5	Y	Y
54	Y	N	N	N	Y	Y	Y	N	CPP	11.2	N	N
55	Y	N	N	Y	Y	Y	Y	Y	CPP	33.1	Y	Y
56	Y	N	N	N	N	N	N	Y	PP	3.2	N	N
57	Y	N	N	N	Y	Y	Y	N	CPP	6.4	N	N
58	Y	N	N	N	Y	Y	Y	N	CPP	12.6	Y	Y
59	Y	N	N	Y	Y	N	Y	N	CPP	9.8	Y	Y
60	N	N	Y	N	N	N	Y	N	FP	11.6	N	N

S. No	Types of nail changes							Serum uric acid (mg/dl)
	salmon patch	subungual hyperkeratosis	Beau's lines	longitudinal ridging	splinter hemorrhages	onycholysis	Joint involvement	
1	N	N	N	Y	N	N	N	7.3
2	N	N	N	Y	Y	N	Y	6.9
3	Y	N	N	Y	N	N	N	8.6
4	N	N	N	N	N	N	N	4
5	N	N	N	N	N	N	N	4.8
6	N	N	N	N	N	N	N	3.9
7	N	N	N	N	N	N	Y	3.9
8	N	N	N	N	N	N	N	6
9	N	N	N	N	N	N	Y	10.6
10	N	N	N	N	N	N	N	4.2
11	N	N	N	N	N	N	N	4.1
12	N	N	Y	Y	N	N	N	5.9
13	N	N	N	N	N	N	N	4.8
14	N	N	N	N	N	N	N	5
15	N	N	N	N	N	N	N	4.7
16	N	N	N	N	N	N	N	5.2
17	N	N	N	N	N	N	N	4.4
18	N	N	N	N	N	N	Y	3.4
19	N	N	N	N	N	N	N	7.2
20	N	N	N	N	N	N	N	6.2
21	N	N	N	N	N	N	N	4.83
22	N	N	N	N	N	N	N	5
23	N	N	N	N	N	N	N	9.6
24	N	N	N	N	N	N	N	5.6
25	N	N	Y	N	N	N	Y	8.2
26	N	N	N	N	N	N	N	8.53
27	N	Y	Y	N	N	Y	Y	4.7
28	N	N	N	N	N	N	N	4.3
29	N	N	N	N	N	Y	N	3.6
30	N	N	N	N	N	N	N	7.6
31	N	Y	Y	N	N	N	N	4.5
32	N	N	N	N	N	N	N	7.4
33	N	N	N	N	N	N	N	6.1
34	N	Y	N	N	Y	Y	Y	4.7
35	N	N	N	N	N	N	N	5.3
36	N	N	N	N	N	N	Y	8
37	N	N	Y	N	N	N	Y	7.9
38	N	N	N	N	N	N	N	6.1
39	N	N	N	N	N	N	Y	6.4
40	N	N	N	N	N	N	N	5.8
41	N	N	N	N	N	Y	N	9.7
42	N	N	N	N	N	N	N	4.2
43	N	N	N	N	N	N	N	4.6
44	N	N	N	N	N	N	N	6.2
45	N	N	N	N	N	N	N	4.5
46	N	N	N	N	N	N	N	6.6
47	N	N	N	N	N	N	N	7.59
48	N	N	N	N	N	N	N	6.4
49	Y	N	N	N	N	N	Y	8.1
50	N	Y	N	N	N	Y	N	5.2
51	N	N	N	N	N	N	N	3.8
52	N	N	N	N	N	N	N	5.6
53	N	N	N	N	Y	N	N	4.7
54	N	N	N	N	N	N	N	6.5
55	N	N	N	N	N	N	N	6.6
56	N	N	N	N	N	N	N	3.5
57	N	N	N	N	N	N	N	6.1
58	N	N	N	N	N	Y	N	4.9
59	Y	N	N	N	N	N	N	6.4
60	N	N	N	N	N	N	N	6.6

S. No	Date	Name	MRD No.	Age (years)	Sex	Marital status	Chief complaints						Swelling	Hairloss	Duration of disease (months)
							Redness	Scaling	Fever	Pain	Blister	Itching			
1	22-03-2021	M	882645	48	F	Married	N	N	N	N	N	N	N	Y	5
2	22-03-2021	DD	797459	42	F	Married	N	N	N	N	N	N	N	N	0
3	02-06-2021	SK	697231	47	F	Married	Y	N	N	N	N	N	N	N	3
4	07-06-2021	RB	1119342	50	F	Married	Y	N	N	N	N	Y	N	N	1
5	18-06-2021	IS	584155	47	M	Married	Y	N	N	N	N	N	N	N	5
6	23-06-2021	AR	1119903	32	F	Married	Y	Y	N	N	N	Y	N	N	0.5
7	30-06-2021	GS	1130072	38	M	Married	N	N	Y	N	N	N	N	N	0.5
8	31-08-2021	GK	718094	49	F	Married	N	N	N	N	N	Y	N	N	2
9	22-09-2021	RS	1282682	63	M	Married	Y	Y	N	N	N	Y	N	N	2
10	07-10-2021	SG	1002052	38	F	Married	N	N	N	Y	Y	N	N	Y	8
11	18-10-2021	SD	82968	52	F	Married	N	Y	N	N	N	Y	N	N	2.5
12	15-11-2021	VP	1207686	60	M	Married	Y	N	N	Y	N	Y	Y	N	7
13	17-11-2021	MK	1209115	26	M	Unmarried	Y	N	N	N	N	Y	N	N	18
14	02-12-2021	NS	1217594	44	M	Married	Y	N	N	N	N	Y	Y	N	1
15	02-02-2022	AW	227702	68	M	Married	Y	N	N	N	N	Y	Y	N	2

S. No	History of any associated illness			Diagnosis	General Physical examination			Morphology of lesions			
	Diabetes Mellitus	Hypertension	Others		Height (m)	Weight (kg)	BMI (kg/m2)	Plaque	Patch	Pustule	Exfoliation
1	N	N	Hypothyroidism	Telogen effluvium	1.57	76	30.6	N	Y	N	N
2	N	N	N	Healthy control	1.52	54	23.25	N	N	N	N
3	N	N	N	Livedo Reticularis	1.73	80	27.62	N	N	N	N
4	N	N	N	Contact Dermatitis	1.55	64	26.6	Y	N	Y	N
5	N	N	Iron deficiency anemia	Geographic Tongue	1.84	78	23	N	Y	N	N
6	N	N	N	Healing drug rash	1.64	75	27.7	N	N	N	Y
7	N	N	N	Tropical Fever	1.79	65	21.16	N	N	N	N
8	N	Y	N	Polymorphic light eruption	1.58	68	27.1	Y	Y	N	N
9	N	N	N	Tinea cruris et corporis	1.8	74	22.8	Y	N	N	N
10	N	N	Absence seizures		1.5	56	24.1	N	N	N	N
11	N	Y	N	Tinea cruris et corporis	1.58	50	19.9	Y	N	N	N
12	N	Y	Hypothyroidism, Varicose veins	Stasis eczema	1.55	63	26.2	Y	N	N	N
13	N	N	N	Chronic spontaneous urticaria	1.7	78	26.8	N	N	N	N
14	N	N	UTI	Heriditary angiodema	1.85	78	4.5	N	N	N	N
15	Y	N	N	Chronic urticaria	1.58	68	27.4	N	N	N	N

S. No	Vesicle	Erosion	Pigmentation	wheals	Scalp	Sites					Nail changes	Joint involvement	Serum uric acid (mg/dl)
						Face	Upper limb	Trunk	Lower limb	Palms & Soles			
1	N	N	N	N	Y	N	N	N	N	N	N	N	5.7
2	N	N	N	N	N	N	N	N	N	N	Y	N	2.7
3	N	N	Y	N	N	N	N	N	Y	N	N	N	4.9
4	N	N	N	N	Y	Y	N	N	N	N	N	N	5.4
5	N	N	N	N	N	Y	N	N	N	N	Y	N	6.58
6	N	N	N	N	N	N	Y	N	Y	Y	N	N	3.1
7	N	N	N	N	N	N	N	N	N	N	N	N	5.4
8	N	N	Y	N	N	N	Y	N	N	N	N	N	5.09
9	N	N	Y	N	N	N	Y	N	Y	N	N	N	7.2
10	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	4.6
11	N	N	Y	N	N	N	N	Y	Y	N	N	N	6.2
12	N	Y	Y	N	N	N	N	N	Y	N	N	N	6.3
13	N	N	N	Y	N	Y	N	Y	N	N	N	N	5.3
14	N	N	N	Y	N	Y	N	N	N	N	N	N	4.8
15	N	N	N	Y	N	Y	Y	Y	Y	N	N	N	5.74

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The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Harleen Kaur**, a student of your college for **MD Dermatology, Venerology & Leprosy** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis .
To study correlation of serum uric acid levels with severity of psoriasis.

Supervisor
Dr. Sunil Gupta
Prof. & Head,
Dept. of Dermatology,
DMCH, Ludhiana.

Co-Supervisor

Dr. Ekta Bansal
Prof.,
Dept. of Biochemistry,
DMCH, Ludhiana.

Dr. Sukhjot Kaur
Assoc. Prof.,
Dept. of Dermatology,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

33. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
34. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

Doctor of Medicine

In

DERMATOLOGY, VENEREOLOGY AND LEPROLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

March 2021

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ABSTRACT OF PLAN OF THESIS

Title	To study correlation of serum uric acid levels with severity of psoriasis
For the degree of	MD Dermatology, Venereology and Leprology
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Introduction: Psoriasis is common, chronic, inflammatory and proliferative condition of the skin, associated with systemic manisfestations in many organ systems. Increased serum uric acid levels in psoriatics are due to increased mitotic activity of the cell. Estimation of serum uric acid levels may facilitate in early diagnosis, treatment initiation and prevention of comorbid conditions.

Aim of Study: To study the serum uric acid levels in patients of psoriasis. To correlate the severity of disease with serum uric acid levels in patients of psoriasis.

Materials & methods: Clinically diagnosed cases of psoriasis attending outpatient and inpatient in Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana during the study period of one year i.e. from 1 March,2021 to 28 February,2022 will be included in the study. BMI matched controls equivalent to 1/4th of the total cases will be taken.

Clinical Significance: Estimation of serum uric acid levels and its association with disease severity may facilitate in early diagnosis, treatment initiation and prevention of comorbid conditions.

Keywords: Psoriasis, Psoriasis area severity index (PASI) score, Serum uric acid

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS"** exist in the Department of Dermatology, Venereology & Leprosy at Dayanand Medical College and Hospital, LUDHIANA and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate herself under our supervision and guidance.

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APPROVAL PROFORMA
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Name of candidate	DR. HARLEEN KAUR
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Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
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4	DATE OF ADMISSION OF COURSE	26 July,2020
5	TITLE OF THE TOPIC	TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Psoriasis is common, chronic, inflammatory and proliferative condition of the skin, associated with systemic manisfestations in many organ systems. Both genetic and environmental influences have a critical role in the aetiology and pathogenesis. Environmental risk factors include streptococcal pharyngitis, obesity, trauma, low humidity etc.[1]

Psoriasis can occur at any age though the mean age of onset for the first occurrence is between 15-20years, with a second peak at 55-60years. Psoriasis vulgaris is the most common type consisting of 90% of all the cases.[2]

Lesions in psoriasis consists of well circumscribed, circular, reddish papules or plaques covered with silvery white or grey scales. Lesions are symmetrical in distribution and most commonly involve scalp, elbows, knees and lumbosacral region. It may also involve body folds. Nail changes can also be seen in psoriasis especially in psoriatic arthritis which include subungual hyperkeratosis, nail pitting, splinter hemorrhages, onycholysis etc.

Clinically the most common symptoms are pain, itch and bleeding. According to the different clinical features, psoriasis is divided into five types: plaque psoriasis, guttate psoriasis or eruptive psoriasis, inverse psoriasis, pustular psoriasis and erythrodermic psoriasis.

Psoriasis is not exclusively a dermatological disease. It can affect various organ systems as well.

The characteristic pathological process involves increased mitotic activity of the basal cell layer resulting in rapid epidermal cell turnover with the 28 day normal epidermal cell cycle reduced to 5 days. The mitotic activity of cells involves purine (adenine and guanine) metabolism, the end product of which is uric acid. Therefore it is likely that increased serum uric acid levels in psoriasis are due to increased mitotic activity of the cell. Serum uric acid levels are expected to vary with duration and severity of disease.

Normal serum uric acid levels in males is 3.4-7mg/dl whereas in females it is 2.4-5.7mg/dl. Hyperuricemia is defined as serum uric acid levels greater than 6mg/dl in females and greater than 7mg/dl in males. Since serum uric acid levels may vary with extent of skin involvement in psoriasis so Psoriasis Area Severity Index (PASI) score is used to calculate the severity of the disease.

Uric acid crystals in our body tend to deposit in skin and joints. Hyperuricemia is not only directly related to gout, but also to cardiovascular disease (especially sudden cardiac death), hypertension, diabetes, metabolic diseases etc. These comorbid conditions often increase the patient's physical and psychological burden.

Being aware of the complications of hyperuricemia, estimation of serum uric acid levels may facilitate in early diagnosis, treatment initiation and prevention of comorbid conditions. Monitoring the levels of serum uric acid levels is necessary for the physicians as well as dermatologists, as many of these conditions are treatable leading to improved quality of life and reduction in physical and psychological burden.

Thus the present study is aimed to determine serum uric acid levels in patients with psoriasis and the association of uric acid levels with disease activity by taking the presence of metabolic syndrome into account, among the patients of different age groups attending the outpatient and inpatient Department of Dermatology in Dayanand Medical College and Hospital, Ludhiana.

6.2 REVIEW OF LITERATURE

Psoriasis is chronic inflammatory skin disease influenced by genetic, environmental and immunological factors. It is characterised by episodes of exacerbations and remission during the course of disease.[2] It results in impaired quality of life and degree of disability. It mainly involves scalp and extensor surfaces of limbs.[3]

The classical clinical manifestations include sharply demarcated, erythematous, pruritic plaques covered in silvery scales. These plaques can coalesce and cover larger areas of skin. Lesions of psoriasis adversely affect the quality of life of the patients. It has been found that it affects approximately 2-4% of the population in the western countries.[4]

Psoriasis can be classified into two categories-Non pustular psoriasis and pustular psoriasis. The former consists of Psoriasis vulgaris, Guttate psoriasis, Erythrodermic psoriasis, Palmoplantar psoriasis, Psoriatic arthritis (PsA), Inverse psoriasis.Pustular psoriasis includes Generalised pustular psoriasis, Impetigo herpetiformis and localised pustular psoriasis.[5]

Pathologically, it is characterized by excessive proliferation and abnormal differentiation of epidermal keratinocytes, infiltration by T lymphocytes and endothelial changes in dermal blood vessels. Physical, chemical or UV injury can cause synthesis and release of cytokines from keratinocytes which stimulates T cells. T cell stimulation can also occur through antigen stimulation via antigen presenting cells.[6] IL17-A/IL23 play a critical role in pathogenesis of psoriasis which has resulted in many new biologic treatments targeting these cytokines.[7]

Skin lesions in psoriasis are due to hyperproliferation of epidermis due to increased cell turnover resulting in increased nucleic acid turnover. End product of nucleic acid being uric acid results in increased serum uric acid levels in patients with psoriasis.[8]

Psoriasis is well known as systemic disease and is associated with other diseases like hypertension, cardiovascular disease, diabetes

mellitus, obesity, hepatosteatosis, hyperlipidemia. Hyperuricemia is also associated with components of metabolic syndrome such as obesity, hypertension and cardiovascular diseases.[9]

Highly raised serum uric acid levels are associated with severe skin lesions and result in increased risk of gout.[10] In hyperuricemia uric acid levels are raised beyond the levels of blood solubility. Therefore uric acid deposits in the form of crystals in the skin and joints which results in chronic tophaceous gout and also stimulate inflammatory cytokines and chemotactic factors for neutrophils..[11

Hyperuricemia is considered as independent risk factor for cardiovascular disease. Reduction in serum uric acid levels results in significant reduction in risk of cardiovascular disease.[12]

Psoriasis can be classified into mild, moderate and severe on the basis of PASI score (Psoriasis area severity index). PASI score is calculated by estimating BSA (body surface area) for head and neck, trunk. Upper extremities and lower extremities and graded from 0-6 with a correction factor of 0.1, 0.2, 0.3, 0.4 for these regions respectively. Erythema, desquamation and induration are then graded (0-4) in each region. The severity rating for the three main target symptoms is multiplied with the numerical value of the areas involved and with the various percentages of the four body areas. The index varies in steps of 0.1 units from 0.0 to 72.0.[13]

PASI score <10 is considered as mild,10-20 as moderate and >20 as severe psoriasis.[14]

Normal serum uric acid levels in males is 3.4-7mg/dl whereas in females it is 2.4-5.7mg/dl.[15]

Baumann et al. conducted a study to compare serum uric acid levels amongst 76 psoriatic patients including 34 males, 42 females and 68 non psoriatic individuals including 30 males, 38 females. Results showed a significantly raised serum uric acid levels in male psoriatic patients as compared to male non psoriatic individuals. Similarly significant difference was seen between female psoriatic patients as compared to female non psoriatic individuals. [16]

In study conducted by Eisen et al. in 1961, out of 38 psoriatic patients 50% had hyperuricemia. Out of those 18 patients,14 had non gouty type of arthritis. Also those with hyperuricemia had advanced skin lesions showing relation between increased epidermal cell turnover and serum uric acid levels.[17]

In study done by Verma et al. at Medical college and Hospital , Rohtak including 135 patients with psoriasis with males to females ratio of 4:1, raised serum uric acid levels were seen in 26.6% of the patients.[18]

In a study conducted by Chand et al., among 50 patients of psoriasis including 40 males and 10 females and 25 healthy controls, 7 (14%) out of 50 patients had elevated serum uric acid levels and no relationship was seen between elevated serum uric acid levels and the extent and severity of disease.[19]

In a study conducted by Golov et al. in 1994 including 1146 patients with psoriasis, high incidence of asymptomatic hyperuricemia was found in 18.8% of the patients. Average level of serum uric acid was elevated in these patients and higher serum uric acid levels were associated with aggravated skin disease like psoriatic erythroderma, exudative psoriasis etc. Also patients with advanced psoriasis had an increased risk of developing apparent gout.[10]

In 2011, study conducted by Jain et al. on 25 patients of psoriasis compared with group of 25 normal subjects (Group I) and a group of 25 patients of other skin diseases (Group II) to evaluate levels of serum uric acid before and after 12 weeks of treatment showed mean serum uric acid concentration to be higher in patients with psoriasis and 80% patients showed significant reduction in serum uric acid levels following treatment.[20]

In a cross sectional study conducted by Kwon et al. including 198 patients of psoriasis, serum uric acid levels showed a positive correlation between PASI score and BMI.Serum uric acid did not show any association with age of disease onset, family history of psoriasis. However extent of body surface area involvement coorelated with the serum uric acid levels.[21]

In case series study conducted by Ghiasi et al. among 126 patients with psoriasis, serum uric acid levels were found to be significantly higher in Non plaque type psoriasis as compared to plaque type. But the mean serum uric acid concentration was within the normal range. It was also found that serum uric acid levels increase with the increase in severity and duration of psoriasis and in psoriatic arthritis. [22]

In a cross sectional study done by Gisondi et al. among 119 psoriatic patients and 119 controls which were age, sex and BMI matched, Increased serum uric acid levels had higher prevalence among patients with psoriasis. Prevalence of asymptomatic hyperuricemia was 19% as compared to 7% among controls.[23]

A study done by Kesli et al. in 2014 including 56 patients with psoriasis and 33 age and sex matched healthy controls showed no significant difference in serum uric acid level between patients with psoriasis and healthy controls. But results were suggestive of significant positive correlation between serum uric acid levels with PASI score and BMI.[24]

In cross section study conducted in 2015 by Yilmaz et al. among 70 patients with psoriasis showed positive and weak correlation between PASI score and hyperuricemia.It was also found that psoriatic nail changes were present in 16 (22.9%) patients and evidence of psoriatic arthritis was present in 23 (32.9%) patients.[9]

In a hospital based cross sectional study including 117 psoriatic patients and 117 controls, it was found that prevalence of hyperuricemia was much higher among psoriasis patients as compared to controls and psoriasis was found to be positive predictive factor for psoriasis.[12]

In the study conducted by Kaushik et al. including 40 cases of psoriasis and 40 controls, serum uric acid levels were found to be higher in cases as compared to controls. History of joint involvement was present in 30% of the cases. Significantly high serum uric acid levels were found in those with severe PASI score, history of joint involvement and increased body surface area involvement.[15]

In a study conducted by Bijina KD et al. including 100 patients of psoriasis, serum uric acid levels were elevated in 16% of the patients.

Raised serum uric acid levels were exclusively seen in males. Twelve out of 16 patients had chronic plaque psoriasis. However no significant correlation was found between serum uric acid levels and PASI score.[25]

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. To study the serum uric acid levels in patients of psoriasis.
2. To correlate the severity of disease with serum uric acid levels in patients of psoriasis.

7. MATERIALS AND METHODS

Clinically diagnosed cases of psoriasis attending outpatient and inpatient in Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana during the study period of one year i.e. from 1 March,2021 to 28 February,2022 will be included in the study. History will be taken. Thorough examination will be done. BMI and PASI score will be calculated.

Blood sample for serum uric acid will be taken in plain vacutainer.

BMI matched controls equivalent to 1/4th of the total cases will be taken. Controls will include healthy individuals, healthy attendants of patients, patients of other skin diseases known to have no effect on serum uric acid levels. Same exclusion criteria will apply to the controls.

Serum uric acid will be done by enzymatic colorimetric method using uricase enzyme on autoanalyzer. Serum uric acid of the patients will be correlated to PASI score, type of psoriasis and will be compared with serum uric acid levels of BMI matched controls.

Method to calculate PASI score-Method to calculate PASI score- To calculate PASI score affected body surface area (BSA) is estimated for the head and neck, trunk, upper extremities and lower extremities separately and graded (0-6) with a correction factor of 10%, 20%, 30%, 40% respectively to allow for the differing surface area of these four regions. Erythema, desquamation and induration are then graded (0-4) in each region. The severity rating for the three main target symptoms is multiplied with the numerical value of the areas involved and with the various percentages of the four body areas. The index varies in steps of 0.1 units from 0.0 to 72.0.[13]

7.1 Source of Data

Clinically diagnosed cases of Psoriasis attending outpatient and inpatient in Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana will constitute the study material and source of data.

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA:

1. Clinically diagnosed cases of Psoriasis vulgaris
2. Patients of any age group and either sex
3. Patients willing to participate

EXCLUSION CRITERIA:

1) Patients not willing to participate
2) Pregnant and lactating woman
3) Patients with history of Leukemia, Polycythemia vera, Gout, chronic liver disease or renal disorder
4) Patients taking drugs known to affect serum uric acid levels such as alcohol, allopurinol, salicylates, ethambutol etc
5) Patients who are taking or have taken Methotrexate in last 3 months

NUMBER OF CASES

Clinically diagnosed cases of psoriasis attending outpatient and inpatient in Department of Dermatology of Dayanand Medical College and Hospital, Ludhiana during the study period of one year i.e. from 1 March,2021 to 28 February,2022 will be included in the study.

OUTCOME

To study correlation between serum uric acid levels and severity of psoriasis.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups will be done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test will be performed and exact test was used when the expected frequency is less than 5. A probability value (p value)less than 0.05 will be considered statistically significant. All statistical calculations will be done using (Statistical Package for the Social

Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Yes, serum uric acid levels.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith.

8. LIST OF REFERENCES

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PROFORMA

S.NO :

Name : Date:

MRD No. :

Age: Sex:

Father/Husband's name:

Occupation:

Marital Status:

Address:

Contact No:

Diagnosis:

Chief complaint:

History of any Associated illness:

Signature of Candidate **Signature of Supervisor**

General Physical examination:

Height(m) Weight(kg) BMI(kg/m^2)

Morphology of Lesions:

Type of psoriasis:

Duration of disease:

PASI Score:

Nail changes:

Joint involvement:

Investigations

Serum Uric Acid:

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o,

S/o..... .....am willing to participate in the study **"TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name: Name:

Signature of Supervisor **Signature of Candidate**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____

गवाह के हस्ताक्षर

नाम:

_____

रोगी के हस्ताक्षर/अंगूठे का निशान

नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"TO STUDY CORRELATION OF SERUM URIC ACID LEVELS WITH SEVERITY OF PSORIASIS" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

_____ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਮਿਤੀ_____

ਪਤਾ _____

ਪਤਾ _____

_____ ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____ ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ